Cada, C.

CZECHOSLOVAKIA/Chemical Technology.                    I-23
          Chemical Products and Their Application--Synthetic
          Polymers.  Plastics

Abs Jour:  Ref Zhur-Khimiya, No 3, 1957, 9837

Author  :  Cada, O.
Inst    :  Not given
Title   :  Nylon Drive Belts

Orig Pub:  Chem. prumysl, 1955, Vol 5, No 11, 475-476 (in
           Czech)

Abstract:  The Gottwald Science Research Institute for
           Plastics Applications (Czechoslovakia) has carried
           out tests on the production of drive belts from
           polycaprolactam strips by drawing the strips
           through slits formed by two machined surfaces.
           The cross section of the slit (in the attachment
           designed for use with a three-roll calender mill)
           was adjusted by means of a wedge; the application
           of electric heating to the edges of the slit made

Card 1/3

CZECHOSLOVAKIA/Chemical Technology. I-23
     Chemical Products and Their Application--Synthetic
     Polymers. Plastics

Abs Jour: Ref Zhur-Khimiya, No 3, 1957, 9837

Abstract: it possible to maintain a temperature of up to
190°. Tests carried out at 130° have shown that
the above method of orienting the strip gives
better results than can be achieved by extrusion-
orientations though the tensile strength of belts
produced by that method is somewhat lower (2500-
3000 kg/cm² against 3000-3500 kg/cm²), the belts
have improved elastic properties and do not exhibit
a tendency to separate in the direction of orient-
ation. The advantages of slit orientation consist
in the possibility of regulating the degree of
orientation by varying the cross section of the
slit width set at 70% of the initial thickness
of the strip, the strip being subjected to pre-
liminary wetting for 24 hours in order to raise
its moisture content from 1-3% to 4-5%. Best
results are achieved in the joining of lengths

Card 2/3

CADA, V.

Civil engineering in the ten years after the nationalization of our construction industry.

P. 57.  (INZENYRSKE STAVBY) (Praha, Czechoslovakia) Vol. 6, No. 2, Feb. 1957

SO:  Monthly Index of East European Accession (EEAI) LC Vol. 7, No. 5, May 1958

CZECHOSLOVAKIA / Chemical Technology, Chemical Products and Their     H-8
                 Application.  Elements.  Oxides.  Mineral Acids.
                 Bases.  Salts.

Abs Jour    : Ref Zhur - Khimiya, No 5, 1959, No. 15943

Author      : Skrivanek, J.; Cada, V.
Inst        : Not given
Title       : Absorption of Sulfur Dioxide in a Venturi Tube

Orig Pub    : Chem. prumysl, 1957, 7, No 7, 340-343

Abstract    : In experiments involving the absorption of $SO_2$ by caustic
              solution (at 0.2% $SO_2$ concentration in the gas), the
              relationship between the degree of $SO_2$ absorption and the
              pressure loss was determined.  The results were in
              agreement with the theoretical expression $[lg(y_0/y_1)]/(L/V) =$
              $= Ak_g$, where $y_0$ and $y_1$ are mol fractions of $SO_2$ in the
              gaseous mixture, L and V are volumes of liquid and gas,
              A is a constant (that is directly proportional to the

Card 1/2

H-21

CADANTU - L.

Q

RUMANIA / Farm Animals.  Swine.

Abs Jour: Ref Zhur-Biol., No 9, 1958, 40489.

Author   : Cadantu, L., Petrescu, C., Popovici, E.,
           Covaliu, V.
Inst     : Not given.
Title    : The Influence of Roots on the Productivity of
           Pregnant Sows.

Orig Pub: Probl. zootehn., 1957, No 3, 26-32.

Abstract: An experiment was conducted at the experimental
          station Rushetsu on 45 sows in the second per-
          iod of pregnancy.  The 1st group was given car-
          rots as a supplement to the basic ration, the
          2nd group - carrots and mangels, and the 3rd
          group - mangels.  As compared with the controls,
          the number of live baby pigs in the 1st group
          was higher by 2.4%, in the 2nd group - by 4.5%,

Card 1/2

CADA, Zdenek, inz.

Project of storing finished products and investment goods. Stroj
vyr 13 no.3:199  Mr '65.

1. Zavody V.I.Lenina National Enterprise, Plzen.

Country        :   Rumania.                                    -1
CATEGORY       :   Farm Animals. General Problems.

ABS. JOUR.     :   RZBiol., No. 4,   1959, No. 16604

AUTHOR         :   Cadantu. L.
INST.          :   Rumanian Scientific Research Zootechnical*
TITLE          :   The Preparation and Application of Vitamin
                   Enriched Hay Used in Animal Feeds.

ORIG. PUB.     :   Probl. zootehn. si veterin., 1957, No 7,
                   39-43

ABSTRACT       :   Good results were obtained at the Scientific
                   Research Zootechnical Institute of the
                   People's Rumanian Republic by feeding piglets
                   and chicken with vitamin enriched hay flour.
                   If 20 percent of concentrates were substitu-
                   ted by lucerne hay flour and beets, weight
                   gains were increased by 26 percent and the
                   flavor of meat improved as compared to con-
                   trols. In the course of 24 days the saving
                   of concentrates amounted to about 10.55 kg
                   per head. Chicks, in whose feeds 20 percent

CARD:          1/2
                    *Institute.

RUMANIA / Farm Animals.  Cattle.                          Q

Abs Jour  :  Ref Zhur - Biologiya, No 2, 1959, No. 7390

Author    :  Cadantu, L.; Gheorghiu, A.; Ionescu, L.
Inst      :  Not given
Title     :  An Experiment Establishing the Influence of
             Carrots on the Milk Production of Cows

Orig Pub  :  Probl. zootehn. si veterin., 1958, No 2,
             29-31

Abstract  :  In the daily ration of the control group
             cows the content of carotene amounted to 232
             mg and of the experimental group which recei-
             ved 10 kg of carrots it amounted to 962 mg.
             Observations which lasted for 24 days showed
             that the average daily milk yield of the con-
             trol group cows amounted to 10.9 kg and of the
             experimental group to 10.6 kg each; eva-

Card 1/2

CADAR, Damian, biolog

Microelements and plant physiological processes. St si Teh Buc
15 no.4:34-35  Ap '63.

CADARIU, Gh.; CRISAN, V.; VLAD, L.; SCHORSCHER, E.; MOISE, Gh.

The phenomenon of physical adaptation in workers employed in hot work-shops. Rev. igiena microb. epidem., Bucur. no.4:42-57 Oct-Dec 54.

1. Dankner Institutul de Igiena, fil. Timisoara.
    (WORK, physiology
        adaptation of organism in workers working  in hot
        work-shops)
    (HEAT, effects
        on workers in hot work-shops)

CADARIU, G., prof.; CORNELSON, D., prof.; STRAUSS, H., assist. prof.; GAVRILESCU, N.
assist prof.; ANASTASATU, C., prof.

The part played by physiology in hygiene and preventive medicine.
Rumanian M Rev. no.1:54-64 Jr-Mr '61.
          (PHYSIOLOGY)    (HYGIENE)    (PREVENTIVE MEDICINE)

RUMANIA

CADARIU, Gh., Prof; BARHAD, B., Dr.

> Institute of Hygiene and Protection of Labor of the
> RPR (Institutul de igiena si protectia muncii al
> RPR) - (for all)

> Bucharest, Igiena, No 5, 1963, pp 385-395

> "Current Problems of Labor Hygiene in the Chemical
> . Industry."

(2)

RUMANIA

CADARIU, Gh., Professor; BARHAD, B., MD; GHEORGHIU, D., MD;
ENCIU, I., Engr; SUFRIN, M., Engr.

Bucharest, Igiena, No 6, Nov-Dec 63, pp 489-492

"Problems of Hygiene and Labor Protection on the Building
Sites in Bucharest."

( 3 )

LUPASCU, Gh., prof.; CADARIU, Gh., prof.; BOSSIC-AGAVRILOAEI, Aspasie-
    COSTIN,P., dr.; HUSCHITT, M., dr.; BOZDOC,I., dr.; MISSITS, Gh.,
    dr. [deceased]; POPOVICI, T., DR.; HAIVAS, Maria, dr.; DOROS, V.,
    dr.

Eradication of an old focus of ancylostomiasis. Microbiologia
(Bucur.) 9 no.3:225-230 My-Je '64

1. Lucrare efectuata in Institutul de igiena din Timisoara,
Statiunea de malarie-helmintologie din Timisoara si Centrul
antihelmintic din Anina.

CADARIU, L.

Storage batteries with perchloric acid. I. Cădariu and E. Schönberger (Chem. Inst. Acad. Sci., Cluj, Rumania). *Acad. rep. populare Romîne, Cluj, Studii cercetări stiinţ., Ser. I, Stiinţe Mat., Fiz., Chim., şi Teh.* **5**, No. 3-4, 115-29 (1954)(French summary).—Preliminary tests showed that storage batteries with a mixt. of $HClO_4$ and aq. $Pb(ClO_4)_2$ as electrolyte performed better than those commonly used. A layer of paraffin oil protected the Pb cathode against atm. air attack. SiC was the only satisfactory anode material. Thus, the secondary cell was $Pb | Pb^{++} + HClO_4 | PbO_2, SiC$. Ni could be used as anode in the primary cell. G. Gxxxxd

CADARIU, I.; NIAC, G.; ONICIU, L.

Determination of the spectrum of absorption in ultraviolet of the complex $FeS_2O_3$ . Studia Univ B-B S. Chem 7 no.1:27-34 '62.

CADARIU, I.; ANDREI, Z.; ONICIU, L.

Complexes of trivalent metals with organic hydroxy acids. Pt.11.
Studia Univ B-B S. Chem 7 no.1:71-75  '62.

CADARIU, I.; COTHA, T.

Complexes of trivalent metals with organic hydroxy acids. Pt.13.
Studia Univ B-B S. Chem 7 no.2:15-22 '62.

CADARIU, I.; ANDREI, Z.

Complexes of trivalent metals with organic hydroxy acids. Pt. 14.
Studia Univ B-B S. Chem 7 no.2:59-80 '62.

CADARIU, I.; GOINA, T.; ONICIU, L.

Complexes of trivalent metals with organic hydroxy acids. Pt. 15.
Studia Univ B-B S. Chem 7 no.2:81-87   '62.

CADARIU, l.; SCHONBERGER, E.

Reaction of methane with carbon monoxide on the Ni-Si and
Co-Si catalyzer. Studia Univ B-B S. Chem 7 no.2:99-104 '62.

CADARIU, I.; ONICIU, L.; SCHMIDT, E.

Complexes of trivalent metals with organic hydroxy acids.
Pt. 17. Studia Univ B-B S. Chem 7 no.2:111-116 '62.

CADARIU, I.; SCHONBERGER, E.

Kinetics of reaction between methane and carbon monoxide in
electric discharges. Studia Univ B-B S Chem 8 no.1: 19-22 '63

1. "Babes-Bolyai" University, Cluj.

OSTROGOVICH, A. [deceased]; CADARIU, I.

Tests of benzoylation of some oxoiminotriazines with benzoic anhydride. Pt. 47.  Studia Univ B-B S. Chem 8  no. 2:19-25 '63.

CADARIU, I.; GOINA, T.

Complexes of trivalent metals with organic hydroxy acids. Pt.
19.  Studia Univ B-B S. Chem 8  no. 2:27-30  '6 .

SOO, A.; GIURGIU, M.; CADARIU, I.

Chromatographic studies on the basic complexes of chromium.
Studia Univ B-B S. Chem 8  no. 2:61-74  '63.

ONICIU, L.; SCHMIDT, E.; CADARIU, I.

Complex compound tert'ary metals with organic hydroxy acid.
Pt. 20. Rev chimie Roum 9 no.12:849-855  D '64.

1. Institute of Physical Chemistry, Babes-Bolyai University,
11 Arany Janos Street, Cluj. Submitted July 9, 1964.

ONICIU, L.; SCHMIDT, E.; CADARIU, I.

Complexes of trivalent metals with organic hydroxy acids. Pt.20.
Studii cerc chim 13 no.12:893-899  D '64.

1. Chair of Physical Chemistry, Faculty of Chemistry, "Babes-
Bolyai" University, Cluj, 11 Arany Janos Street.

CADEK, A.; Mikyska, L.

"Disturbances in superheaters of steam generators."

ENERGETIKA, Praha, Czechoslovakia, Vol. 5, no. 1, Jan. 1955

Unclassified

FAHRNER, R., inz.; CADEK, A.; POUR, B., inz., dr.; HLUBUCEK, inz.;
    PFLEGER, V.; NETUSIL, J.; REISS, L., prof., inz.; KOHOUT,
    J.; KRIKA, J.; VLASAK, J.; VLACH, J., inz., dr.; CERNY, St.;
    KALDROVIC, P.; JIRASEK, J.; BURES, J.; SCHIFFLER, O., inz.;
    LIDICKY, Fr., inz.; BRAUNER, J., inz.

Record of the 1st National Conference of the Czechoslovak
Scientific and Technical Society, Section for Power Engineering,
held in Prague, April 1961. Energetika Cz 11 no.6:Suppl.:
Energetika 11 no.6:1-11 '61.

CADEK, J.; KACURA, G.; MALKOVSKY, M.

Genetic relations between the thermal springs and Neoidic
rock mineralization in the Teplice and Usti nad Laben
areas. Vest Ust geol. 38 no.4: 265-268 Je '63.

1. Ustredni ustav geologicky, Praha.

ČADEK, J.

The Effect of Tungsten on Susceptibility to Temper-Brittle-ness. J. Cadek. (*Hutnické Listy*, 1955, 10, (5), 285-293). [In Czech]. The efficiency of tungsten in preventing temper brittleness in 35% Cr-2% V and in 15% Ni-4% Cr low-alloy steels was investigated and compared with similar effects obtainable with molybdenum, primarily with a view of replacing the latter by the former. Replacement was found to be possible, optimum tungsten additions being at most 80% greater than the molybdenum additions prescribed by Czechoslovak Standard Specifications.—P. F.

On Two Types of Pearlitic and Ferritic Reactions in Alloy
Steels. J. Cadek. (Hutnické Listy, 1955, 10, (7), 409–413).
[In Czech]. The kinetics of the isothermal reaction leading to
Hultgren's so-called 'parapearlite,' and the low-temperature
pearlitic reactions were studied thermo-magnetically. Hult-
gren's postulate of this pearlite is challenged on the basis of
the results obtained. Low-temperature pearlite formation is
shown to occur by other processes than at high temperatures.
The amount of low-temperature pearlite formed depends on
the temperature of formation, showing a maximum at a
certain temperature. A new type of low-temperature ferritic
reaction was observed to occur at about the same temperature
as the low-temperature pearlitic reaction, preceding the latter.
The amount of low-temperature ferrite formed also depends
upon the temperature and also has a maximum. The mech-
anism of initiation of this reaction remains obscure. The
isothermal decomposition of austenite in many alloy steels
was found to be a complex process consisting, in a given range
of temperatures, of as many as five reactions occurring as a
sequence, the later stages being related to those immediately
preceding them.—F. F.

CADEK, J.

The Effect of Tungsten on the Isothermal Dec...
of Austenite in the Size of M.(C)...

...
...

...
...detected ferrite was observed...
austenite in the 2.8% W steel decomp mes...
temperature range only with the simultaneous...
both ferrite and carbide within. The carb...
not appear in the process. The effect of tungsten
stability of austenite in the ferrite pearlite state...
ably dependent upon the austenization temperature...
becomes insignificant below a certain content of tungsten.
On the whole, raising the austenization temperature from 900
to 1300° C results in increased stability of the austenite in the
ferrite-pearlite domain. Hultgren's hypothesis of the existence
of " parapearlite " is shown to be untenable.- -P. F.

ČADEK, J

Determination of small amounts of selenium in pyrites and similar materials. J. Doležal and J. Čadek (Chem. Listy, 1955, 49, 1152—1157).—The method consists of separating Se by distillation as $SeBr_4$ from a solution containing Br and HBr, dissolving the Se, obtained by reduction with hydroxylamine hydrochloride, in $HNO_3$, evaporating with $H_2SO_4$, neutralizing with ammonia and determining Se polarographically. For 5-g. samples with Se content 0·005—0·05%, error is <10% and decreases with increasing [Se].

G. GLASKE.

Cadek, J.

On the Mechanism of the Action of Alloying Elements on the Eutectoid Reaction. N. T. Gudcov and J. Cadek. (Hutnické Listy, 1956, 11, (4), 199-207). [In Czech.] The paper represents an abridged version of a doctoral thesis dealing with the carbide phases of pre... decomposition of austenite if ...

... the eutectoid reaction the carbide formed is $M_{23}C_6$ where M may represent more than one metal, i.e. Fe and Mo. This phase was not, on the other hand, observed on prolonged heating of martensite. (3) In the case of a 43 ... W steel the stable carbides are cementite and W... isothermal decomposition of austenite the formation of a granular eutectic containing $M_6C$ was first observed, and only after a certain amount of this phase had been formed was the formation of a lamellar eutectoid with ... formula being $M_{23}C_6$. Cementite formed ... of the austenite decomposition of this ste... but forms again in specimens heated for ... Similar results were obtained with a ... steel, the stable carbide phases of which are W... and $M_{23}$...

*Gudcov, N.T. and Cadok, J.*

(5) The rate of segregation of tungsten in austenite in the vicinity of the pearlite/austenite phase boundary is considerably more rapid than the rate of partition of tungsten between the components of the ferrite-carbide mixture. The formation of pearlite is related to this segregation. The carbide $M_{11}C_4$, which is formed in the process of the decomposition of the austenite, may contain less tungsten than the cementite formed during the decomposition of martensite in the same steel. It follows from this that the limited solubility of tungsten in cementite is not responsible for the fact that the latter does not immediately transform into $M_{11}C_4$. (6) The complexity of the observed reactions shows that the interpretation of the mechanism requires the taking into account of kinetic and thermodynamic process s.—P. V.

2/2

CADEK, J.

Isothermal Decomposition of Austenite in Steels Containing Tungsten. (PART II). The Effect of Tungsten on the Isothermal Decomposition in the Steel 35CrBV. J. Cadek. (Hutnicke Listy, 1956, 11, (7), 409-419). [In Czech]. S-Curves were obtained for four steels, each containing 0.37% C, 1.75% Cr, 0.23% V and either 0.00, 0.38, 0.98 or 1.57% W. Thermomagnetic, metallographic, X-ray, and microchemical methods were used to study and isolate the carbide phases resulting from the decomposition, which took place either at 900 or at 1300° C. Two minima were observed in the stability in the ferrite-pearlite range in the two steels with the highest tungsten contents presumably due to two reactions. The bainitic reaction was studied. In this region high austenitizing temperatures are reflected in comparatively high austenite stability. The effect is ascribed to the relation between the number of nuclei formed and the austenizing temperature. The Bs-temperature decreases with increasing tungsten content; the Ms-temperature remains essentially unaffected. Additions of about 1% of tungsten begin to have an effect on the stability of the austenite. The effect is not great, but the temperature domain of stability is considerably increased. Lesser amounts of tungsten are less effective. The effect of the austenitizing temperature on austenite stability in the ferrite-pearlite range increases uniformly with tungsten content. A comparison of the effect of tungsten on the austenite stability in the steels 18Cr3Ni4, 25MnCrV, 35CrV2 shows that from the point of view of hardenability W-Ni-Cr combinations are best, alloying with W-Mn-Cr being somewhat inferior.—P. F.

CADEK, J.

Use of microanalytical methods in the study of the isothermal disintegration
of austenite.  p. 216.
(Hutnicke Listy, Vol. 12, no. 3, March 1957.  Brno, Czechoslovakia)

SO:  Monthly List of East European Accessions.  (EEAL)  LC. Vol. 6, No. 6,
     June 1957.  Uncl.

CADEK J.

CZECHOSLOVAKIA/Physics of Solids - Phase Conversion in Solid Bodies E-6

Abs Jour : Ref Zhur - Fizika, No 2, 1958, No 3451

Author   : Mazanec Karel, Cadek Josef
Inst     : Not Given
Title    : Effect of Tungsten on the Kinetic Parameters During the Formation of Pre-eutectoid Ferrite.

Orig Pub : Hutnicke listy, 1957, 12, No 6, 492-500

Abstract : A study was made of the influence of tungsten on the speed of formation and on the growth of nuclei of pre-eutectoid ferrite in isothermal decomposition of austenite. It was established that tungsten reduced the speed of formation of nuclei practically independently of the temperature. As the content of tungsten increases the speed of formation at low temperatures (below 650° C) falls substantially while at high temperatures (approximately 740° C) it remains almost constant. The dependence of the speed of formation of nuclei on the time is established: after the lapse of incubation period it raises rapidly, reaches a maximum and then again diminishes hyperbolically.

Card     : 1/1

HUTNICKÉ LISTY
Vol XII, Nr 7, 1957

Eutectoid Reaction. Part I. Pearlite Reaction in Carbon Steels

The author discusses critically on the base of literature data the pearlite reaction in carbon steel. The discussion leads to the conclusion, that investigations of the pearlite reaction in Fe—C alloys have advanced at the present time to such an extent, that they form the necessary basis for the study of the mechanism of the effects of alloying elements upon this reaction.

Considerable attention is devoted in this study to various attempts of theoretical analysis of the pearlite reaction and its parameters. It may be stated that although these attempts are generally based on considerably simplifying assumptions, they nevertheless contribute a great deal to the improvement of our conception of the pearlite reaction.

CAdeK   JoSeF

CZECHOSLOVAKIA/Solid State Physics - Phase Transition in Solids      E-6

Abstract : A microscopic and electron-macroscopic investigation was made
           of the process of nitro cementation of steel.  It was found
           that when the layer contains more than 0.5% nitrogen, micro-
           scopic porosities are formed during the process of nitro cemen-
           tation of part of the grain boundaries of the austenite in the
           diffusion layer.  The conditions of formation of the micropores
           and their shapes are investigated.  It is found that the cause
           of formation of the micropores is the liberation of N in the
           form of molecular, non-diffusing $N_2$ from the atomic N in the
           solid solution of N in the austenite.  Separation of N in
           molecular form, in turn, is connected with the local thermo-
           dynamic activity of N on the grain boundaries, an activity

Card     : 1/2

CZECHOSLOVAKIA/Solid State Physics - Phase Transitions in Solids     E-6

Abs Jour : Ref Zhur - Fizika, No 4, 1958, No 8279

connected not only with the contents of N in the layer, but
also with the concentration of the carbon. The condition
for the formation of microscopic porosities on the grain
boundaries of the austenite is that the difference in the
crystallographic orientation of the neighboring grains ex-
ceed a certain critical value. The nuclei of the pores oc-
cur in those places where the interaction between the neighbor-
ing grains is disturbed in the boundary layer. The results
obtained confirm experimentally the correctness of the theore-
tical (island) model of the grain boundary, proposed by Mott
(Mott, N.F., Proceedings Physical Society, 1948, 60, 391).

Card     : 2/2

CADEK, J.

Eutectoid reaction. It. 2.   Eutectoid and pearlite reaction in alloy steels.

p. 687 (Hutnicke Listy)   Vol. 12, no. 8, Aug. 1957, Praha, Czechoslovakia

SO:   MONTHLY INDEX OF EAST EUROPEAN ACCESSIONS (EEAI) LC, VOL. 7, NO. 1, JAN. 1958

CADEK, J.; MAZANEC, K.

Isothermal decomposition of austenite in tungsten-alloyed steels. Pt. 3.  Effect of tungsten on the isothermal austenite decomposition of austenite in hypoeutectoid carbon steel.

p. 777 (Hutnicke Listy)  Vol. 12, no. 9, Sept. 1957, Praha, Czechoslovakia

SO:  MONTHLY INDEX OF EAST EUROPEAN ACCESSIONS (EEAI) LC, VOL. 7, NO. 1, JAN. 1958

*CADEK, JOSEF*

CZECHOSLOVAKIA/Solid State Physics - Diffusion. Sintering                E-7

Abs Jour  : Ref Zhur - Fizika, No 6, 1958, No 13189

Author    : Cadek Josef, Janda Emil
Inst      : Vyzkumny ustav hutnictvi zeleza, Prague, Czechoslovakia
Title     : Methods of Studying the Diffusion with the Aid of Radio-
            active Isotopes

Orig Pub  : Hutnicke listy, 1957, 12, No 11, 1008-1020

Abstract  : Examination is made of methods for measuring the coefficient
            of diffusion with the aid of radioactive isotopes. In some
            of these methods, the use of radioactive isotopes contributes
            to an increased sensitivity, accuracy, and speed . Other
            methods are based on the interaction between the radioactive
            radiation and the substance. These methods, called absorption
            methods, are suitable particularly because their use requires
            neither subdivision of the specimens into a layer nor exact
            measurements of small distances.

Card      : 1/1

CADEK - JOSEF

CZECHOSLOVAKIA/Solid State Physics - Phase Transitions in Solids    E-6

Abs Jour : Ref Zhur - Fizika, No 11, 1958, No 25240

Author  : Cadek Josef, Tlusta Degmar
Inst    : Not Given
Title   : The Bainite Reaction, Part I. Properties of the Bainite
          Reaction

Orig Pub : Hutnicke listy, 1958, 13, No 2, 123-133

Abstract : The authors discuss the characteistic feature of the bainite
           transformation as compared with ferrite and pearlite, trans-
           formation, on the one hand, and with the martensite trans-
           formation on the other. In psite of the fact that the bainite
           transformation differs from the martensitic one in the dif-
           fusion character, there is a deep analogy between the two.
           Since the stabilization phenomenon is of great importance in
           the explanation of the kinetics of the bainite reaction and
           for a formulation of a theory for it, the authors discuss in
           great detail the experimental facts pertaining to this phen-
           omenon. The article contains also a collection and a critical
Card    : 1/2

$C A D E K, J.$

CZECH/34-58-3-7/23

AUTHORS: Likeš, Jiří (Ing.), Mazanec, Karel (Cand.Tech.Sci.,Ing.),
Čadek, Josef (Cand.Tech.Sci.,Ing.)

TITLE: Application of Statistical Methods for Studying the Isothermal Decomposition of the Austenite. Part II. Methods of Measuring the Speed of Formation of Germinations and the Speed of Growth (Použití statistických metod při studiu isotermického rozpadu austenitu. Cast II. Metody mereni rychlosti tvorby zarodku a rychlosti rustu)

PERIODICAL: Hutnické Listy, 1959, Nr 3, pp 215-222 (Czechoslovakia)

ABSTRACT: The first part of this work was published in Hutnické Listy, 1957, Nr 3, p 216. It was shown in Part I that the basic parameters which determine the kinetics of isothermal decomposition of austenite are the speed of formation of germinations and the linear speed of their growth. The morphology of the decomposition products which has a decisive influence on the mechanical and other properties is determined primarily by the ratio of these parameters. Therefore, for understanding the mechanism of the influence of alloying elements on the decomposition of austenite, it is necessary to know the influence of alloying elements on these parameters. Earlier work by the authors (Ref 2) on the influence of tungsten on the speed of formation of germinations and on the speed of growth of hypo-

Card 1/4

CZECH/34-58-3-7/23

Application of Statistical Methods for Studying the Isothermal Decom-
position of the Austenite. Part II. Methods of Measuring the Speed of
Formation of Germinations and the Speed of Growth

eutectoidal ferrite during isothermal decomposition of austen-
ite has enabled arriving at important conclusions on the mech-
anism of the influence of tungsten on the ferritic reaction
and has also contributed to elucidating certain general char-
acteristics of the kinetics and the mechanism of this reaction.
Correct interpretation of the results of measurement of the
kinetic parameters presupposes basic knowledge of the present
theory of formation of germinations and of their further growth.
Therefore, the first, earlier published, part of this work was
devoted to theoretical fundamentals. This second part of the
paper is devoted to statistical methods of measuring the kinet-
ic parameters. Although in the first instance the authors
aimed at studying the decomposition of austenite, the work
went considerably beyond the scope of this problem. Measure-
ment of the speed of formation of germinations and the speed
of their growth is based on several basic operations of quan-
titative stereometric metallography, namely, determination of

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CZECH/34-58-3-7/23

Application of Statistical Methods for Studying the Isothermal Decomposition of the Austenite. Part II. Methods of Measuring the Speed of Formation of Germinations and the Speed of Growth

the phase composition, determination of the number of particles per unit of volume, determination of the specific surface, etc. For the purpose of determining the speed of formation of germinations it is necessary to determine the fraction of non-transformed austenite as a function of the reaction time, the number of particles of a given decomposition product per unit of volume, also as a function of time, and the area of the boundaries of $\gamma$-grains per unit of volume (in cases in which it is necessary to ordinate the speed of formation of germinations to a unit of the area of $\gamma$-grain boundaries). In the first part of the paper the authors deal briefly with the methods of quantitative determination of these three magnitudes and also with other methods of calculating the speed of formation of germinations. In the second part of the paper the most important methods of determining the speed of growth are dealt with and a method of measuring the distance between lamellae, which is one of the most important parameters affecting the speed of growth, is described. In view of the large number of available methods the authors could not deal with any of them in detail.

CZECH/34-58-3-7/23

Application of Statistical Methods for Studying the Isothermal Decomposition of the Austenite. Part II. Methods of Measuring the Speed of Formation of Germinations and the Speed of Growth

They propose to do that in later work which will be devoted to a narrower field of investigation. There are 5 figures and 24 references, of which 5 are Czech, 2 German, 1 French, 4 Soviet and 12 English.

ASSOCIATION: Výzkumný ústav hutnictví železa, Praha (Ferrous Metallurgy Research Institute, Prague)

SUBMITTED: September 13, 1958.

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CADEK, J.

"Determination of the origin of nonmetallic inclusions in steel by means of a $Ca^{45}$ radioactive isotope."

HUTNICKE LISTY, Brno, Czechoslovakia, Vol. 14, No. 6, June 1959.

Monthly List of East European Accessions (EAI), LC, Vol. 8, No. 9, September 1959.

Unclassified.

69269

Z/034/60/000/04/005/028

E073/E535

18.7100

AUTHORS: Mazanec, Karel, Engineer, Candidate of Technical Sciences
(Výzkumný ústav VŽKD, Ostrava), Čadek, Josef, Engineer,
Candidate of Technical Sciences, Likeš, Jiří, Engineer
(Výzkumný ústav hutnictví železa, Praha)

TITLE: Influence of Nickel on the Speed of Formation of
Germinations and on the Speed of Growth of Hypoeutectoidal
Ferrite

ABSTRACT: Earlier work by the authors of this paper (Refs 1,2)
relating to the influence of W on the kinetic parameters
showed that in the case of high degrees of super-cooling
the speed of growth of the ferrite is controlled by the
diffusion of carbon in the austenite. Therefore the
authors considered it of interest to obtain information
on the influence of nickel, an element which does not
form carbides in steel. For the investigations two
steels were used of the following compositions:
Steel A: 0.27% C, 0.26% Mn, 0.25% Si, 0.033% P, 0.026% S,
         0.14% Cu, 0.04% Ni, 1.0% Cr;
  "   B: 0.31% C, 0.33% Mn, 0.25% Si, 0.033% P, 0.024% S,
         0.16% Cu, 1.17% Ni, 1.03% Cr.

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69 × 69

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Influence of Nickel on the Speed of Formation of Germinations and
on the Speed of Growth of Hypereutectoidal Ferrite

These steels were produced in a 40 kg capacity high
frequency furnace and cast into ingots which were then
forged into rods of 20 mm dia.  Prior to manufacture
the samples were subjected to sphereodisation annealing
for 4 hours at 700°C.  Specimens of 10 x 10 x 2 mm were
homogenization annealed in special ampoules without
access of air for the duration of one week at 1050°C.
Following that the specimens were electrolytically coated
with a chromium layer about 0.03 mm thick, to prevent
decarburization.  Austenization was effected at 1100°C
for 10 minutes in a vertical tubular furnace inside a
protective argon atmosphere.   On the basis of the
obtained results it is concluded that:
1) Nickel reduces considerably the speed of ferrite
growth, particularly at high degrees of supercooling
(700° to 650°C).  The influence of nickel on the speed
of formation of germinations could not be determined.
2) The speed of ferrite growth in the range of high
degrees of supercooling is obviously controlled by the
speed of carbon diffusion in the austenite since the

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Influence of Nickel on the Speed of Formation of Germinations and on the Speed of Growth of Hypereutectoidal Ferrite

obtained activation energy of the growth (31 000 cal/mol for the steel A and 26 700 cal/mol for the steel B) approaches the activation energy of the diffusion of carbon in the austenite.

3) An analysis was made of the isothermal ferritic reaction and the activation energy of this reaction was determined. The obtained values of the activation energy (37 500 cal/mol for steel A and 35 000 cal/mol for steel B) lead to the conclusion that the speed of diffusion of C in the austenite probably controls not only the speed of growth at high degrees of supercooling but also the entire kinetics of the ferritic reaction.

There are 13 figures, 2 tables and 11 references, 3 of which are Czech, 4 Soviet and 4 English.

ASSOCIATIONS: Výzkumný ústav VŽKG, Ostrava (Research Institute VŽKG, Ostrava) and Výzkumný ústav hutnictvi železa, Praha (Ferrous Metallurgy Research Institute, Prague)

SUBMITTED: June 27, 1959

Card 3/3

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80268
Z/034/60/000/06/009/053
E073/E335

AUTHORS:     Čadek, Josef and Tykal, Kamil

TITLE:       A New Mechanism of Isothermal Decomposition of Alloyed
             Austenite

PERIODICAL:  Hutnické listy, 1960, Nr 6, pp 450 - 455

ABSTRACT:    A new mechanism is described of decomposition in the
             eutectoidal range, which is closely related to the non-
             steady process of eutectoidal decomposition of austenite.
             This mechanism was observed in studying precipitation of
             carbides in Cr-W steels, the results of which will be the
             subject of a separate paper. The investigated steels
             contained about 12.5% Cr, 0.5-0.6% C, 3 or. respectively,
             5.5% W; the full composition is given in    Table 1,
             on p 450. The steel was produced in a 10-kg medium-
             frequency furnace with a magnesite lining and cast into
             ingots weighing 7 kg. For the tests, the ingots were
             forged into 16 mm dia rods which, prior to manufacture,
             were normalised from 900 °C and tempered for 2 hours at
             700 °C and then cooled in air. Austenisation was effected
             at 1 300 ± 10 °C for 30 min. The isothermal treatment
             was effected in a thermostat and a "sleeve" furnace at

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A New Mechanism of Isothermal Decomposition of Alloyed Austenite

$650 \pm 3$ °C. Long-run annealing of the products of isothermal decomposition of austenite was effected in a "sleeve" furnace after easling the isothermally trans- formed specimens into quartz ampoules. After heat treatment, the surface layer was removed from all the specimens to a depth of 0.5 - 0.6 mm to eliminate the influence of decarburisation. The electrolytic isolation of the carbides was effected by a method described in another paper. X-ray phase analysis of the isolated carbides was effected by the Straumanis asymptotic method, using $CoK_{\alpha1,2}$ radiation. The average exposure time was 2.5 hours (40 kV, 18 mA). For isolating the carbides the isothermally-treated specimens were subjected to metallo- graphic analysis. After removing a 0.5 mm thick layer from one of its faces, each specimen was ground on emery paper and polished and etched electrolytically in a bath consisting of glacial acetic acid and perchloric acid (11:1). The electrolytic polishing and etching was effected

Card 2/5 for 2 min at 0.5 $A/cm^2$ with intensive cooling of the

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A New Mechanism of Isothermal Decomposition of Alloyed Austenite

electrolyte by flowing water; most of the specimens had
to be additionally etched with Vilella-Bain etching fluid.
The exposures were made with magnifications of 200X and
800X. The results of X-ray study of a carbide phase of
the decomposition products for a temperature of 650 $^{\circ}$C are
entered in Table 2 for isothermal soaking periods of up to
5 000 hours. It was found that the two-phase (eutectoidal)
decomposition of the solid solution is not connected with
concentration changes in the main non-transformed body of
the original phase. A typical example of such a decom-
position is the formation of pearlite in Fe-C alloys.
Due to the fact that its progress involves concentration
changes in the main body of the non-transformed austenite,
the non-steady state eutectoidal reaction is not a two-
phase decomposition in the classical sense. Whilst the
two-phase decomposition (pearlitic transformation) was
intensively studied for carbon and low-alloy steels, the
non-steady state reactions have been studied only in
individual cases and their mechanism is almost unknown.

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EO73/E335
A New Mechanism of Isothermal Decomposition of Alloyed Austenite

The isothermal decomposition of austenite in steels
containing 0.5 - 0.6% C, 12.5% Cr and 3-5.5% W begins
at 650 °C and has a non-steady state eutectoidal reaction,
the progress of which involves a drop in the concentration
of carbon in the non-transformed austenite. As a result
of that, the eutectoidal transformation will stop after a
certain time and the remaining austenite will decompose,
bringing about formation of ferrite and precipitations of
carbides in this formed ferrite. Thus, the non-steady state
eutectoidal transformation leads in the given case to
qualitative changes of the mechanism of the decomposition,
for instance, to an arresting of the eutectoidal trans-
formation and to a decomposition of the remaining austenite
linked with the formation of ferrite and the precipitation
of carbides in the ferrite, whereby the carbide particles
increase primarily as a result of the diffusion of carbon
from the non-transformed austenite into the ferrite. The
mechanism of the austenite decomposition, which is linked
with ferrite formation and precipitation of carbides in
Card 4/5   the formed ferrite, is described in the paper in considerable

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A New Mechanism of Isothermal Decomposition of Alloyed Austenite

detail.  There are 19 figures, 2 tables and 8 references,
of which 4 are English and 4 Czech.

ASSOCIATION:   VÚHŽ, Prague

SUBMITTED:  February 15, 1960

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8C~80

Z/034/60/000/08/006/030
E073/E335

*18.7500*

AUTHORS:     Likeš, Jiří, Čadek, Josef, Mazanec, Karel and
             Kudělková, Jarmila

TITLE:       Contribution to the Methods of Stereometric Metallography.
             Part III.  Method of Determining the Number of and the Size
             of Disc Particles to Disperse Phase

PERIODICAL:  Hutnické listy, 1960, Nr 8, pp 615 - 619

ABSTRACT:    Methods of quantitative evaluation of the microstructure
             of metals and alloys are gaining in importance in the
             study of phase transformations.  The kinetics of the
             majority of such transformations can be described by two
             kinetic parameters, the speed of formation of the nuclei
             and the speed of growth of a new phase.  Measurement of
             these parameters is based on using statistical methods
             of microstructural analysis.  One of the most important
             tasks is determining the number of particles in the new
             phase per unit of volume of the specimen and the real
             (three-dimensional) size of these particles on the basis
             of the number and size of intersections of particles per
             unit of area of a polished specimen or on the basis of the
             length and the number of segments created by the

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Contribution to the Methods of Stereometric Metallography.
Part III.   Method of Determining the Number of and the Size of
Disc Particles to Disperse Phase

intersection of particles of a polished specimen with
lines drawn at random in the plane of the polished
specimen.   Such particles can have a variety of shapes,
i.e. they can be spherical, cylindrical, acicular, disc-
shaped, etc.   In earlier papers (Refs 1,2), one of the
authors dealt with spherical particles.   For studying
martensitic and bainitic reactions it is important to
develop a method of determining the number of disc-
shaped particles.   In this paper, the authors solved
this problem for the case of particles of equal size
with a random distribution and random orientation in
the body of the specimen.   Expressions are derived for
the average number of particles per unit of volume and
for the size of the particles  k, D  whereby all the
expressions depend on the average number of intersections
n  per unit of area of the polished plane of the specimen,
the average number of intersections  n'  per unit of
length of longitudinally-drawn straight lines and on

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Contribution to the Methods of Stereometric Metallography.
Part III. Method of Determining the Number of and the Size of
Disc Particles to Disperse Phase

estimating the value of $p$, the volume part of the
phase $\alpha$. The value of $k$ is then determined by
interpolation from tabulated $\varphi(k)$ values. In the
experimental part of the paper, comparison is made
between the average $\bar{F}$ of the areas of the polished
sections measured and the theoretically determined value
$E(f)$. Finally, the theoretically derived relations
are used for determining the number and size of bainite
particles. The here described method enables direct
measurement of the kinetic parameters of proceeding
isothermal, martensitic and, particularly, bainitic
reactions. Acknowledgments are expressed to V. Kejha,
VÚHŽ, for his assistance in carrying out measurements
on the polished specimens and to J. Kazdova, VÚHŽ, for
her assistance in carrying out calculations. There are
5 figures, 4 tables and 13 references, of which 5 are
Czech, 7 are English and 1 is Soviet.

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Z/034/60/000/08/006/030
Contribution to the Methods of Stereometric Metallography. E073/E335
Part III.  Method of Determining the Number of and the Size of
Disc Particles to Disperse Phase

ASSOCIATIONS:    Výzkumný ústav hutnictví železa, Praha
        (Ferrous Metallurgy Research Institute, Prague)
        Výzkumny ústav, VŽKG, Ostrava (Research Institute,
        VŽKG, Ostrava)

SUBMITTED: August 25, 1959

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Z/046/61/000/004/002/009
D007/D102

AUTHORS:    Čadek, J., Engineer, Candidate of Sciences, and Foldyna, V.,
            Engineer, Candidate of Sciences.

TITLE:      Heat-treatable, high-temperature, 12% Cr steels in power
            engineering.

PERIODICAL: Zváračský sborník, no. 4, 1961, 372-390

TEXT:  The article describes efforts made to increase the heat-resistance
of 12% Cr steels used in power engineering. The ČSSR has so far developed
the AK2MV, AK2WC and T58 modified Cr steel types and further efforts are
being made to increase the heat-resistance of 12% Cr steels by (a) addition
of Nb and/or Ti; (b) addition of B or B and N; (c) combining the methods
(a) and (b); and (d) increasing the content of carbide-forming elements
with simultaneous addition of Co to reduce the formation of $\delta$-ferrite.
The article describes in detail tests with the Soviet EI 756 and EI 757
steels, modified by addition of Nb and B, and Ti and B, respectively; tests

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Heat-treatable, ...

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designed to verify information contained in literature on 12%Cr steels,
modified by addition of carbide-forming elements and of B and N; and tests
designed to verify the properties of the Soviet EI 993 steel. It was found
that properties of EI 756 and EI 757 steels can be improved by the addition
of 0.12 - 0.20% Nb, while addition of Ti produced poor plastic properties,
due to the high content of $\delta$ -ferrite. Verification tests were made with
Cr steels of various compositions. However, the measured creep strengths
did not reach the high values listed in literature. The tests, therefore,
eventually concentrated on the 20Cr12MoWVNbB steel. Its properties were
compared with those of unmodified 20Cr12MoWV steels. It was found that the
modified steel has a higher creep strength at temperatures above 575°C,
while all other properties remain satisfactory. Turbine runners made of
20Cr12MoWVNbB steel have higher yield strength, same ductility, and
somewhat higher contraction and notch toughness than runners made of AK2MV
steel. For manual arc welding of the modified steel, electrodes are being
tested which have a composition similar to the parent metal. In conclusion,
the authors state that creep-strength values of 20Cr12MoWVNbB steel, heat-

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Heat-treatable, .....

treated to a strength 80 - 85 kg/mm$^2$, i.e. $S_{TP/10}4$ = 14.0 kg/mm$^2$, and $S_{TP/10}5$ = 7.7 kg/mm$^2$, as measured by the Larson-Miller method, are lower than the actual potentialities of that steel type, and that final conclusions cannot yet be made. There are 9 figures, 10 tables, and 11 references: 5 Soviet-bloc, 3 non-Soviet-bloc, and 3 unidentified. The references to the 2 English-language publications read as follows: Hagel, Becht, Schenectady, Structural Stability of Modified 12-Chromium Alloys. Trans. ASME, October 1956, 1439-1446; Kauhausen, Kaesmacher, The Problem of Welding High Temperature Service Materials, British Welding Journal, December 1960, 558-707. (Technical Editor: Engineer J. Malý of the VÚZ Bratislava).

ASSOCIATION: VÚHŽ Praha (VÚHŽ Prague) (J. Čadek)
            VÚ VŽKG Ostrava (V. Foldyna)

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S/137/62/000/006/150/163
A057/A101

AUTHORS:      Čadek, J., Foldyna, V.

TITLE:        Thermally treated heatproof steels with 12% chromium in power engineering

PERIODICAL:   Referativnyy zhurnal, Metallurgiya, no. 6, 1962, 5, abstract 6E30
              ("Zvárač. sb.", 1961, v. 10, no. 4, 372 - 390, Czechoslovakian;
              Russian, German and English summary)

TEXT:         The investigation of heatproof steel with 12% Cr is described.  The
tests were carried out on forged pieces of steel 20Cr12MoWV and 20Cr12MoWVNbB.
Above 575°C steel 20Cr12MoWVNbB showed a higher friction $10^5$ value than a steel
without Nb and B at 600°C i.e. at a temperature lower by 25°C.  For the manual
arc welding of both steel types, electrodes of the same chemical composition as
the base metal are used.

                                                          V. Tarisova

[Abstracter's note:  Complete translation]
Card 1/1

MYSLIVEC, Theodor; CADEK, Josef; MANDL, Miroslav; VRSEK, Jaroslav;
BRODSKY, I.; LUBOVSKY, M.

Effect of the quality of ceramic runners on the micropurity of
steel used for making railway wagon tires. Part 2: Investigation
on determining the origin of nonmetallic inclusions in steel by
radioactive isotopes. Hut listy 16 no.2:94-102 F '61.

1. Vyzkumny ustav, Vitkovicke zelezarny Klementa Gottwalda,
Ostrava (for Myslivec, Brodsky and Lubovsky). 2. Vyzkumny
ustav hutnictvi zeleza, Praha (for Cadek, Mandl and Vrsek).

FREIWILLIG, Rudolf; CADEK, Josef; BRONEC, Josef

Kinetics of decarburization of cold rolled silicon steel transformer sheets in the $H_2-H_2-H_2O$ and $CO-CO_2-H_2-H_2-H_2O$ atmospheres. Hut listy 16 no.9:645-651 S '61.

1. Vyzkumny ustav hutnictvi zeleza, Praha.

1% 1130
1% 1111

28602 Z/047/61/000/011/001/004
D007/D102

AUTHOR:     Cadek, Josef, Engineer, Candidate of Sciences

TITLE:      Saving metals by development and introduction of new steel
            types

PERIODICAL: Technická práce, no. 11, 1961, 937-941

TEXT:  The article describes efforts made in the ČSSR to save scarce alloy
elements, especially Ni and Nb, by developing low-alloy steels with improved
mechanical properties.  Ti and V additions to ČSN 11523 (St 52) MnSi steel
and to MnCrSi steel (for thicknesses from 25-50 mm) have led to the develop-
ment of steel types ČSN 11483, 11583, 11603 with increased yield points, and,
eventually, to a MnVN steel type which has a minimum yield point of 45 kg/mm$^2$.
Most suitable for welded structures are steel types ČSN 11483, 11603 and
MnVN, since they need not be preheated.  Czechoslovak high-grade construc-
tion steels numbers 12 - 16 already contain fewer scarce alloy elements,
however, their properties can still be improved.  The following B-alloyed
steel types have been developed for the automotive and tractor industry:

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ČSN 12042 (a B-modified ČSN 1242) which is successfully used instead of ČSN 14240 and 14331 Mn-Cr steels; ČSN 14230 which is used instead of ČSN 15260 Mn-Cr-V steel and number 16 Ni-steels; ČSN 12051 steel designed to replace carburized steel used for several automotive parts. Another B-alloyed steel is the 20 MnCrB carburizing steel which is also used for automotive parts (gear wheels) instead of ČSN 14220 and/or ČSN 16220 CrNi steels. The VŽKG steel plant has developed two fine-grained, Ti-alloyed MnCr carburizing or nitriding steels, comparable to the Soviet 18KhGT and 30KhGT steel types. These steels can be heat-treated at higher temperatures (gas carburization at 1,050 - 1,100°C) and can replace the ČSN 16220 Ni steel. Also, the following new refractory and stainless steels, permitting the saving of Ni, have been developed: ČSN 14461 (MnCrTi), ČSN 17482 (MnCrV), and ČSN 17483 (MnCrMoV) which are destined for large steam-generator pipes and have a higher creep strength than foreign 16/13 Nb steel. The SONP steel plant in Kladno has developed the AKRE steel type which is a Mo- W- and V-alloyed, Ti-stabilized, 13/12 austenitic CrNi steel with refractory properties comparable to the well-known Soviet EI 695R steel. The following stainless, austenitic steels have been developed in the ČSSR: (1) ČSN 17460 which is an

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austenitic 18/9 Cr Ni steel in which 50% of the Ni contents were saved by
doubling the amount of Mn and the addition of 0.20% N. This steel is pro-
duced by the SONP and the VŽKG steel plants; (2) N 7470 which contains
17.5% Cr, 15.5% Mn, 0.5% Mo, and 0.35% N; (3) N7471 which has the same com-
position as the N 7470, except that it contains 1.5% Ni and 1% Si and no Mo.
The production of this steel type is currently being introduced at the VŽKG
steel plant. These steels replace the steel types ČSN 17241 and ČSN 17242.
They have 100% higher yield points (up to 40 kg/mm²) than conventional CrNi
steels, and are characterized by high ductility and notch toughness which
remain unimpaired by low temperatures down to -200°C. Stabilized stainless
steels, developed on the basis of Soviet EP 53, EI 811, and EP 54 steels,
are designated Cr21Ni5Ti (substitute for ČSN 17246) and Cr21Ni6Mo2Ti (sub-
stitute for ČSN 17347) and contain 50% less Ni, and somewhat more Cr than
the classic steel types which they are meant to replace. However, they can
be used only up to 250°C due to their tendency to become brittle. The SONP
steel plant in Kladno has also developed a stainless construction steel,
designated AKVH, which contains 0.1% C, 17% Cr, 7% Ni, 0.7% Ti, and 0.2% Al.
After heat treatment (solution annealing and subsequent hardening at 450 -
500°C), the ultimate yield point of this steel reaches 120 kg/mm² and quench-

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ing is not required to improve mechanical properties. At the present time, the construction of a new plant for the production of anisotropic and oriented transformer sheets is being projected. Also an improved technology for cold-rolling of sheets for dynamo laminations is being studied and slated to be gradually introduced during 1962-67.

ASSOCIATION:   Výzkumný ústav hutnictví železa, Praha (Research Institute of Iron Metallurgy, Prague)

Card 4/4

CADEK, J.; FREIWILLIG, R.; DUPAL, O.

Reaction between carbide and mother metal in some steel alloys. Hut
listy 16 no.12:874-885   D '61.

1. Vyzkumny ustav hutnictvi zeleza, Praha.

(Steel alloys)   (Carbides)

18.1152    1521 1418 4016

AUTHORS:     Čadek, Josef, Engineer, Candidate of Science,
             Cochnár, Zdeněk, Engineer and Freiwillig, Rudolf,
             Engineer

TITLE:       Equilibrium conditions of iron-rich Fe-Cr-V-C alloys
             at carbon concentrations of 0.30% and a temperature
             of 700°C

PERIODICAL:  Hutnicke listy, no.2, 1962, 122-129

TEXT:        In another paper (which is in the process of publica-
tion in Hutnické listy) the authors and their team emphasize the
importance of the study of the properties of the individual
structural components and their mutual reactions from the point
of view of developing refractory steels and alloys. The subject
of this paper is the study of the isoconcentration section through
the isothermic Fe-Cr-V-C tetrahedron for chromium concentrations
between 0 and 16%, vanadium concentrations between 0 and 5% and
a carbon concentration of 0.30% at the temperature of 700°C. The
authors also studied the equilibrium conditions in the iron-rich
alloys Fe-Cr-Mo-C and Fe-Cr-W-C; however, the results of this work
will be the subject of separate papers. The iron-rich range of

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Equilibrium conditions of ...

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the Fe-Cr-V-C section for 0.20% C and a temperature of 700°C was
studied by S.W.K.Shaw and A.G.Quarrell (Ref.2: J.inst.185, 1957,
no.4, 314). Relating to their results it is shown in this paper
that doubts exist on whether an equilibrium state was achieved and
whether the results of X-ray analysis of the isolated carbide
phases were analysed critically enough. The here given results
are intended as a contribution to the theoretical bases of
the development of pearlite-ferrite, martensite and martensite-
ferrite high-temperature steels. The experiments were carried
out with 20 mm rods forged from ingots weighing 1.2 kg produced in
chill moulds and annealed for four hours at 700°C to improve
machinability. The material was produced by smelting in a medium
frequency 10 kg furnace, using as charge material the steel
ČSN 12013 of the following composition: 0.10% C, 0.29% Mn,
0.02% Si, 0.014% P, 0.023% S, 0.09% Cu, 0.02% Ni, 0.02% Cr.
The deoxidation was by silicomanganese followed by aluminium
(0.05%), metallic chromium was added after deoxidation and then,
after thorough mixing, carbon was added using a synthetic Fe C
alloy of the following composition: 4.38% C, 0.33% Mn, 0.02% Si.

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Equilibrium conditions of ..       Z/034/62/000/002/001/002
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0.018% P, 0.029% S, 0.13% Cu, 0.03% Ni and 0.11% Cr. Immediately
afterwards vanadium was added in the form of ferrovanadium alloy
and the melt was teemed.    After forging, the rods were air-cooled
and then annealed for four hours at 700°C.   From these, 14 mm
diameter x 32 mm cylinders were produced and sealed into quartz
ampoules to prevent decarburization and annealed at 700°C ±3°C
for a duration of 5000 hours in a chamber furnace.   Then the
specimens were air-cooled.   Prior to isolating the carbides, a
layer of 0.7 to 1 mm thick was removed so as to eliminate the
influence of possible oxidation.   In the tests the carbides were
electrolytically isolated and subjected to microchemical analysis
and X-ray analysis using $CrK\alpha_{1,2}$ radiation.   Furthermore, micro-
structural analysis and hardness measurements were carried out.
Investigation of the kinetics of the reaction of the carbide
phase with the basic solid solution in Cr-V steels has shown
that, even at 650°C, annealing for 5000 hours is sufficient for
achieving an equilibrium state (Ref.17: Z.Cochnár and J.Čadek.
Research Report VÚHŽ, being prepared for publication).   Therefore,
the isoconcentration section through the isothermic Fe-Cr-V-C

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tetrahedron shown in Fig.1 represents the real equilibrium diagram.
Direct comparison of the results with those of Shaw and Quarrell
is possible only in single instances.   As regards the diagram
itself, comparison could not be carried out since the diagram of
Shaw and Quarrell related to 0.20% C, whilst the here given
results relate to 0.30% C.   Comparison of the chemical compositions
of the individual carbides with those determined by Shaw and
Quarrell is problematical since in a number of cases these authors
did not achieve the equilibrium state.   The view expressed by
H. J. Goldschmidt (Ref.8: J.Iron St.Inst.160, 1948, no.4. 345) and
V. Foldyna and J. Wozniak (Ref.9: Hutnické listy 15, 1959, no.1 33)
that vanadium has a low solubility in the cementite $M_3C$ was found
incorrect; the solubility of vanadium in $M_3C$ may reach 6 to 7%. In
the carbide $M_{23}C_6$ the solubility of vanadium is considerably higher
(up to 13%) than in the carbide $M_7C_3$ (up to 6.5%). The solubility
of chromium and iron in the carbide $M_4C_3$ is up to 7% and 5.7%,
respectively. The results have shown that there is a strong inter-
action between components of the system Fe-Cr-V-C and therefore
laws that are valid for diluted solutions are inapplicable for this

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system even at low concentrations of chromium and vanadium.
There are 17 figures, 3 tables and 21 references: 7 Soviet-bloc
and 14 non-Soviet-bloc.   The English-language references read
as follows: Ref.2: quoted in text: Ref.4: E.Smith and J.Nutting,
J.Iron St.Inst.187, 1957, no.4, 314; Ref.8: quoted in text;
Ref.20: K.H.Jack, J.Iron St.Inst.169, 1951, no.1, 26.

ASSOCIATION:   Výzkumný ústav hutnictví železa, Praha
               (Iron and Steel Research Institute, Prague)

SUBMITTED:     July 4, 1961


Fig.1. Legend.  Isoconcentration (0.30% C) section through the
                isothermic (700°C) Fe-Cr-V-C tetrahedron.

                Concentration,wt.%  vs. Cr concentration, wt.%

                Oblast - phase; označení oblasti - phase designation;
                symbol fázového složení slitiny -  symbol used for
                the phase composition of the alloy.


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Fig.1
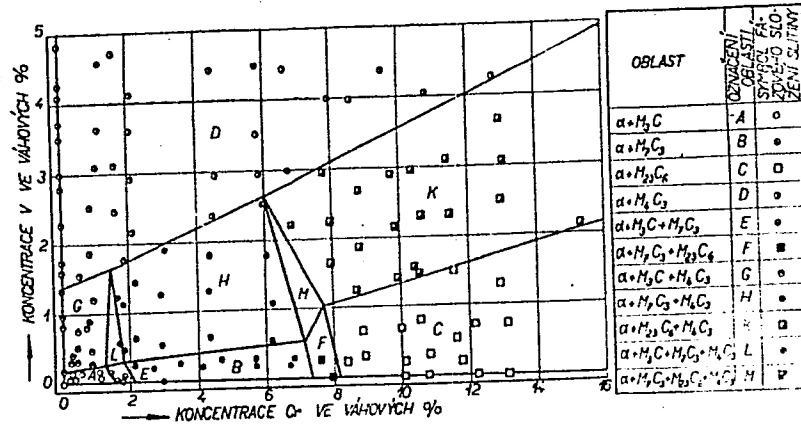


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18.7500

Z/034/62/000/004/001/005
E073/E335

AUTHORS:    Cadek, Josef, Engineer and Freiwillig, Rudolf,
Doctor of Sciences, Engineer

TITLE:      States of equilibrium of iron-rich Fe-Cr-W-C alloys
with a carbon content of 0.20% at 700 °C

PERIODICAL:   Hutnické listy, no. 4, 1962, 273 - 282

TEXT:      Present knowledge of carbides and intermetallic
phases which may be present in the system Fe-Cr-W-C in a stable
form is reviewed in the first part of the paper.  The latter
part of the paper deals with experimental results based on 198
alloys with carbon contents varying between 0.18 and 0.23%.  The
experimental alloys were subdivided in accordance with their
carbon content.  The Mn and Si contents were determined for
180 experimental alloys; whilst the P, S, Ni and Cu contents
were determined from 48 samples and the Al content was deter-
mined for 20 randomly chosen specimens.  The composition of
these elements was as follows (%):

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| Content, % | Mn | Si | P | S | Cu | Ni | Al |
|---|---|---|---|---|---|---|---|
| Minimum | 0.08 | 0.02 | 0.021 | 0.021 | 0.14 | 0.05 | 0.01 |
| Maximum | 0.38 | 0.34 | 0.028 | 0.028 | 0.17 | 0.07 | 0.068 |
| Average | 0.18 | 0.13 | 0.025 | 0.024 | 0.16 | 0.06 | 0.02. |

The samples were sealed into quartz ampules and annealed for
5 000 hours at 700 $\pm$ 3 $^{\circ}$C, a time which was ample
for achieving an equilibrium state, at least as far as the
structure was concerned.  The results of phase analyses are
plotted in the form of a section of equal concentration
(0.20% C) of the isothermal (700 $^{\circ}$C) Fe-Cr-W-C tetrahedron
in Fig. 1, where the vertical axis gives the tungsten concen-
tration and the horizontal axis gives the chromium concentration,
both in wt.%.  It can be seen from the diagram that within the
investigated range of concentration there were five two-phase
regions, A, B, C, D, E, eight three-phase regions, F,G;H,K,L,M,
N,O and four four-phase regions, P,R,S,T.

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The existence of all these regions, except for the four-phase
region .P , was experimentally proved.  Acknowledgmgnts are expressed
to Engineer K. Mazanec, Candidate of Sciences, VÚ VZKG,
Ostrava, for his comments on the experimental results.
There are 20 figures and 4 tables.

ASSOCIATION:    Výzkumný ústav hutnictvi železa, Praha
                (Iron and Steel Research Institute, Prague)

SUBMITTED:      September 14, 1961

Fig. 1 (smaller figure)  - Key:  1 - region;  2 - designation of
regions;  3 - symbol denoting phase composition of the alloy.

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E073/E335

AUTHORS:    Cadek, Josef, Doctor of Sciences, Engineer,
            Freiwillig, Rudolf, Engineer and Sio Si San,
            Candidate of Sciences, Engineer

TITLE:      Equilibrium states of iron-rich Fe-Cr-Mo-C alloys
            with a carbon concentration of 0.35% at 700 °C

PERIODICAL:   Hutnické listy, no. 7, 1962, 507 - 516

TEXT:      The isoconcentration section through the isothermal
tetrahedron Fe-Cr-Mo-C for Cr contents of 0 - 16% and Mo contents
of 0 - 10% was determined by means of electrolytic isolation of
carbides which were then subjected to radiographic and micro-
chemical analyses.  178 test alloys were used in which the carbon
concentration varied between 0.32 and 0.38%, the average being
0.35%.  Fig. 1 is the resulting diagram (0.35% C, 700 °C) giving
the concentration of Mo in wt.% as a function of the concen-
tration of Cr in wt.%.  The letter designation of the areas in
the diagram (A - T) as well as the symbols of the phase compo-
sition of the alloys are given in Table 4.  Table 5 gives the
chemical and phase compositions of the alloys for which no
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equilibrium state was reached after annealing for 10 000
and even 15 000 hours.  The relatively low solubilities of Mo
in $M_3C$ cementite (limit concentration not in excess of 1.2%)
and of Mo in $M_7C_3$ carbide were confirmed.  The maximum concen-
tration of Mo in $M_{23}C_6$ was 11% and did not reach a value
corresponding to the ideal composition of $Fe_{21}Mo_2C_6$ (composition
of the metastable $M_{23}C_6$ carbide in a ternary Fe-Mo-C alloy).
Since Mo lowers the minimum concentration of Cr at which $M_{23}C_6$
is formed, the Cr concentration in the carbide $M_{23}C_6$ of this
type of alloy  can  vary   within wide limits.  Even a very low
chromium concentration suppresses, or at least strongly retards,
the formation of MC carbide.  In the investigated range of Cr
and Mo concentrations, the  $\eta$  phase does not exist in a stable
form.  In earlier investigations of carbide precipitation in
Cr-Mo steels at 650 °C and in studies of the structural changes

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in Fe-Cr-Mo-C alloys with 12% Cr and 6% Mo, no precipitation
of the η phase was detected in the temperature range
500 - 800 °C. However, the stable existence of $\chi$ was detected.
There are 14 figures and 6 tables.

ASSOCIATION:   Vyzkumný ústav hutnictví železa, Praha
               (Research Institute for Iron-mining, Prague)

SUBMITTED:     August 26, 1961

Table 1.

Key - 1 - Zone
      2 - Zone designation
      3 - Symbol used for the
          phase composition
          of the alloy

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Z/034/62/000/008/002/004
E073/E535

AUTHORS:    Kadek, J., Engineer, Dupal, O. Doctor of Science and
            Freiwillig, R. Engineer

TITLE:      Precipitation of carbides in alloy steels.
            Part I. Precipitation of carbides during tempering of
            chromium-molybdenum steels at 650°C

PERIODICAL: Hutnické listy, no.8, 1962, 573-580

TEXT:       This and the succeeding parts of the study relate to
the precipitation of carbides in chromium-molybdenum, chromium-
tungsten and chromium-vanadium steels at 650°C in the case of
tempering for periods between 6 min and 5000 hours, as well as for
the case of isothermal decomposition of austenite and annealing
at the same temperature for periods up to 5000 hours of the
products of this decomposition.   In this first part the results
relating to fifteen chromium-molybdenum steels with compositions
as given in Table 1 are reported.   The results of studies of the
precipitation of the carbide $M_2C$ and the reaction $M_2C \rightarrow M_6C$ were
the subject of earlier work (Hutnické listy, 16, 1961, no.12,
p.874), where the precipitation of the carbides in some of the

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Fifteen steels (CM2, CM5, CM9, Cm10 and CM12) studied in this paper was also reported. The carbides were isolated electrolytically and then subjected to X-ray diffraction and chemical analyses. The most frequently observed carbides, particularly in the case of high alloyed steels, were $M_{23}C_6$ and $M_6C$. This is attributed to the tendency of chromium and molybdenum to form in Fe-Cr-Mo-C alloys carbides which are characteristic for Fe-Cr-C and Fe-Mo-C alloys, although they are distinguished by a sufficiently high solubility of iron and of the other element (Mo or Cr), but not to form carbides $M_7C_3$ or MC, which have a low solubility for molybdenum and possibly also for chromium and iron. The carbide $M_{23}C_6$ may contain only 11.2% Cr and 5.2% Mo and even less or, on the other hand, it may contain up to 11.5% or even more of molybdenum; the chromium concentration in $M_6C$ may be as high as 9%. Even a very slight addition of chromium into molybdenum steels causes a radical slowing down, or completely suppresses, the formation of MC carbide. In the equilibrium state the solubility of molybdenum in $M_7C_3$ is only about 2% but in the metastable state it may reach 10%; molybdenum reduces the rate of

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the reaction $M_5C \to M_7C_3$.     At chromium concentrations of up to
1.5-2% the stability of the carbide $M_2C$ is only slightly affected
by the chromium content; however, at higher concentrations
chromium reduces the stability of $M_2C$.    The iron concentration
in $M_2C$ may reach about 10% and in some cases it may reach 27%.
The chromium concentration may reach 22%.    The view is widely
held that if the solubility of a given element in a given
carbide is less than the concentration of this element in the
solid solution, the carbide may accept the given element in a
concentration not higher than the concentration in the solid
solution.    It was found that this view is not generally valid,
for instance, $M_5C$ which precipitates during 6 min tempering in
the steel CM7 (1.15% Mo and 4.2% Cr) contained 5.3% Mo and 2.6% Cr;
the authors could not explain this phenomenon.    Neither the
precipitation of the intermetallic Laves phase $Fe_2Mo$ nor the
formation of a quaternary carbide could be proved for any of the
steels investigated; all the carbides which precipitated and
which existed in the stable state were derived from carbides of
the appropriate binary or ternary sub-systems. There are 16
figures and 3 tables.
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ASSOCIATION: Výzkumný ústav hutnictví železa, Praha
             (Iron and Steel Research Institute, Prague)

Table 1

| Steel | Composition,% | | | | | Ratio[*] | |
|---|---|---|---|---|---|---|---|
| | C | Mn | Si | Cr | Mo | $\xi_{Cr}$ | $\xi_{Mo}$ |
| CM1 | 0,37 | 0,21 | 0,02 | 1,35 | 0,48 | 0,842 | 0,162 |
| CM2 | 0,33 | 0,26 | 0,04 | 1,50 | 0,92 | 1,050 | 0,341 |
| CM3 | 0,39 | 0,46 | 0,02 | 1,63 | 1,97 | 0,965 | 0,632 |
| CM4 | 0,38 | 0,20 | 0,10 | 1,65 | 3,29 | 1,001 | 1,083 |
| CM5 | 0,30 | 0,21 | 0,04 | 1,69 | 5,70 | 1,301 | 2,375 |
| CM6 | 0,47 | 0,38 | 0,42 | 4,51 | 0,56 | 2,215 | 0,149 |
| CM7 | 0,42 | 0,39 | 0,40 | 4,22 | 1,15 | 2,321 | 0,331 |
| CM8 | 0,36 | 0,34 | 0,43 | 4,74 | 2,13 | 2,957 | 0,714 |
| CM9 | 0,39 | 0,49 | 0,30 | 4,28 | 3,55 | 2,532 | 1,137 |
| CM10 | 0,41 | 0,31 | 0,32 | 4,25 | 5,45 | 2,394 | 1,662 |
| CM11[**] | 0,37 | 0,27 | 0,25 | 4,39 | 6,62 | 2,740 | 2,240 |
| CM12[**] | 0,25 | 0,28 | 0,33 | 4,57 | 5,77 | 4,215 | 2,885 |
| CM13[**] | 0,60 | 0,25 | 0,11 | 12,56 | 2,00 | 4,819 | 0,417 |
| CM14[**] | 0,48 | 0,29 | 0,31 | 12,87 | 3,22 | 6,182 | 0,839 |
| CM15[**] | 0,46 | 0,39 | 0,39 | 13,46 | 6,26 | 6,756 | 1,703 |

[*] $\xi_{Cr} = \dfrac{at.\% \ Cr}{at.\% C}$         $\xi_{Mo} = \dfrac{at.\% \ Mo}{at.\% \ C}$

[**] Austenization temperature 1250°C

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Z/034/62/000/009/001/007
E073/E535

AUTHORS:    Cadek, Josef, Engineer, Candidate of Science and
            Freiwillig, Rudolf, Engineer

TITLE:      Precipitation of carbides in alloy steels.
            Part II. Precipitation of carbides during tempering of
            chromium-tungsten steels at 650°C

PERIODICAL: Hutnické listy, no.9, 1962, 648-655

TEXT:         In Part I of this paper (Hutnické listy, no.8, 1962,
573-580) the results were described of carbide precipitation
studies in fifteen chromium-molybdenum steels, tempered at 650°C
for periods between 6 min and 5000 hours.  This second part
contains results of carbide precipitation studies under the same
conditions of thirteen chromium-tungsten steels with compositions,
Table 1, such that these steels can be considered as pure
quaternary Fe-Cr-W-C steels. Results: The presence of chromium in
tungsten steels extends the range of W concentration in which $M_6C$
may form as a transient phase.  This may be due to the widening
of the range of stable existence of this carbide by chromium. In
Cr-W steels $M_6C$ may occur during tempering, either as a stable or
metastable phase without preliminary deformation of the transient
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carbide $M_2C$. The presence of W in Cr steels extends considerably the range of concentration in which the carbide $M_{23}C_6$ can form and exist in a stable manner; the Cr and W concentrations in the carbide $M_{23}C_6$ may vary within wide limits. $M_{23}C_6$ and $M_6C$ are the most frequently observed carbides in Cr-W steels, particularly in high alloyed ones. This is caused by the tendency of the Cr and W to form in Fe-Cr-W-C alloys carbides which are specific to Fe-Cr-C and Fe-W-C alloys but are characterized by a sufficient solubility of the second element (W or Cr) and of iron. However, there is no tendency to form the carbides $M_7C_3$ and MC, which have a low solubility for tungsten, chromium and iron. Even a small addition of Cr into W steels leads to a drastic slowing down or complete supression of formation of the carbide MC. The solubility of tungsten in $M_7C_3$ is only about 1.5% in the equilibrium state but in the metastable state the W concentration in $M_7C_3$ carbides may be much higher, since it can be considerably higher than the W concentration in the solid solution, reaching at least 5.3%. In the $M_3C$ cementite, present in the metastable state, the W and probably, also the chromium concentrations may be considerably higher than the equilibrium level with the ferrite of tungsten or chromium steels and,

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simultaneously, the concentration of these elements in $M_3C$ may be higher than in the mother solid solution; the causes of this phenomenon cannot be explained.   In the initial stages of its existence, $M_2C$ may contain high concentrations of iron and chromium; the latter hardly increases at all the stability of $M_2C$ at low concentrations and probably increases slightly at higher concentrations.   In Cr-W steels $M_2C$ is considerably less stable than in Cr-Mo steels.   In none of the studied steels could the precipitation of the Laves phase $Fe_2W$ be proved and this fact is explained by the strong influence of the C content on the minimum W concentration (in the case of a chromium concentration of about 12%) at which this phase can exist.   All the carbides that precipitate and exist in a stable manner in the studied steels are derived from  carbides of the appropriate binary and possibly ternary sub-systems.   Thus, the conclusion of Kuo (J.Iron Steel Inst.185, 1957, no.3, p.297) was confirmed that no quaternary carbide exists in Fe-Cr-W-C alloys.   There are 12 figures and 3 tables.

ASSOCIATION:   Výzkumný ústav hutnictví železa
Card 3/4       (Iron and Steel Research Institute)

Precipitation of carbides ...          Z/034/62/000/009/001/007
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SUBMITTED:     September 16, 1961

Table 1

Steel        Chemical composition,%     Ratio*

| | C | Mn | Si | Cr | W | ξ Cr | ξ W |
|---|---|---|---|---|---|---|---|
| CW1 | 0,41 | 0,45 | 0,09 | 0,85 | 0,66 | 0,48 | 0,11 |
| CW2 | 0,40 | 0,20 | 0,05 | 1,62 | 0,53 | 0,91 | 0,09 |
| CW3 | 0,38 | 0,58 | 0,04 | 1,61 | 1,17 | 0,98 | 0,20 |
| CW4 | 0,43 | 0,38 | 0,05 | 1,90 | 2,58 | 1,02 | 0,30 |
| CW5 | 0,42 | 0,38 | 0,23 | 1,70 | 5,38 | 0,93 | 0,84 |
| CW6 | 0,40 | 0,32 | 0,03 | 1,75 | 10,29 | 1,01 | 1,68 |
| CW7 | 0,41 | 0,45 | 0,13 | 4,46 | 1,17 | 2,52 | 0,19 |
| CW8 | 0,45 | 0,67 | 0,23 | 4,28 | 2,04 | 2,20 | 0,30 |
| CW9 | 0,43 | 0,38 | 0,14 | 4,22 | 4,87 | 2,37 | 0,74 |
| CW10 | 0,41 | 0,38 | 0,14 | 4,33 | 9,60 | 2,44 | 1,53 |
| CW11 | 0,51 | 0,27 | 0,12 | 12,46 | 3,02 | 5,64 | 0,39 |
| CW12 | 0,60 | 0,37 | 0,16 | 12,53 | 5,30 | 4,82 | 0,58 |
| CW13 | 0,59 | 0,24 | 0,07 | 11,83 | 9,70 | 4,51 | 1,07 |

$$* \quad \xi Cr = \frac{at.\% \ Cr}{at.\% \ C} \ , \qquad \xi W = \frac{at.\% \ W}{at.\% \ C}$$

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4OO47

18.1130                                    Z/034/62/000/010/002/002
                                           E073/E335

AUTHORS:    Čadek, J. and Foldyna, V.

TITLE:      Heat-treated, scale-resistant 12% Cr-base boron-
            and nitrogen-alloyed steels (Partial concluding
            research report)

PERIODICAL:   Hutnické listy, no. 10, 1962, 760

TEXT:      The report contains an analysis of published
information on scale-resistant, heat-treated 12% Cr-base
steels which, in addition to other alloying elements, contain
boron, nitrogen and combinations of boron and nitrogen.
According to data published in the literature, a particular
feature of such steels is the excellent scale-resistance of
steels alloyed with a combination of boron and nitrogen.
However, the results given in the report indicate that if the
impact strength is not to drop below a permissible limit,
austenization temperatures should not be higher than 1 100 °C -
a temperature too low for achieving a high scale-resistance.
Metallurgical factors may greatly influence the scale-resistance
and the plasticity indices, particularly the notch impact
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Heat-treated, scale-resistant...

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strength of steels alloyed with boron and nitrogen. However, information on the influence of these factors is not available. Steels alloyed with a combination of boron (0.03%) and nitrogen are difficult to shape and this finding is the main reason why investigation of this steel is limited to a minimum and why it is not continued. Steel of the following composition has satisfactory mechanical properties and a good scale-resistance: 0.20% C, 0.60% Mn, 0.40% Si, 11.5% Cr, 0.5% Mo, 0.5% W, 0.25% V, 0.25% Nb and 0.005% B. The report contains the results of "orientational" research on this steel. Further results will be published in the final report.

Card 2/2

CADEK, Josef

Colloquy on the creep of metals and alloys and the fracture
during the creep. Vestnik CSAV 72 no.5:598-61. '63