Study of the Precipitation of X-carbide in Tempered Medium and Low Carbon Steels(Metallurgy)

independent on temperature, while the latter is independent on strain and dependent on temperature.

The long-range interaction component could be explained by the Ashby's plastic constraint theory. The short-range interaction component could be explained by the image force mechanism.

A General Treatment of the Distribution of Vacancies to Solute Atoms in a Ternary Solid Solution and its Application to Low Temperature Aging in Al-Cu-Sn Alloys

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Trnas. Japan Inst. Met., **16** (1975), 361.

A general treatment to calculate the concentration of vacancy-solute atom pairs in a ternary dilute solid solution is presented. This treatment is applicable to a wide range of vacancy concentration relative to the concentration of one kind of solute atoms.

The treatment is applied to explain the effect of tin addition on the rates of low temperature aging in Al-Cu alloys. The difference in the activation energy for aging between Al-Cu alloys and an Al-Cu-Sn alloy is analyzed to find the binding energy of a vacancy-tin atom pair to be about 0.3 eV larger than that of a vacancy-copper atom pair. The experimental result that the retardation of aging due to tin addition is appreciable only for tin concentrations larger than the vacancy concentration is also explained satisfactorily.

Kinetics of Precipitation of Carbon in Molybdenum at about 250°C

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Acta Metall., **23** (1975), 1009.

Kinetics of the precipitation of carbon in molybdenum at about 250°C are studied in detail by resistivity measurements. The rate of this precipitation stage is controlled by the diffusion of carbon atoms. The activation energy for carbon diffusion at this temperature range is determined to be 1.2 eV, which is appreciably smaller than the activation energy reported so far for carbon diffusion measured at high temperatures, about 1.7 eV.

Study of the Precipitation of χ-carbide in Tempered Medium and Low Carbon Steels

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Trans. Iron, Steel Inst. Japan, **15** (1975), 79.

Observations by transmission electron microscopy have been made on quenched and tempered carbon steels containing 0.017%, 0.15% and 0.48% carbon to investigate the precipitation behaviours of χ-carbide in lower carbon steels with

regard to those already clarified for high carbon steels by the present authors.

The main results obtained are summarized as follows:

(1) There exists χ-carbide in the tempering process of low (0.017%, 0.15%C) and medium (0.48%C) carbon steels.

(2) The habit plane of the χ-carbide in the medium carbon steel is $\{112\}_a$, suggesting that the carbide precipitates preferentially on martensite twin boundaries.

(3) The orientation relationship of the χ-carbide with ferrite matrix of low and medium carbon steel is approximately expressed as $(100)_x//(\bar{1}\bar{2}1)_a$, $(010)_x//(101)_a$, and $[001]_x//[\bar{1}11]_a$.

Constant Stress Creep Tester Using the Servo Divider

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Trans. Japan Inst. Met., 16 (1975), 207.

In order to examine the transient creep, especially its initial stage in detail, a new constant stress creep tester has been developed. The load necessary to maintain the stress constant can be obtained by an automatic control system with a servo divider, which calculates the equation, as $W=W_0 l_0 (l_0+x)$, where W_0 is the initial load, l_0 is the initial gauge length and x is the elongation of the specimen. The specimen is stretched by the dead weight of water which is controlled in accordance with the calculated value. The system has the advantages of giving the load under a constant loading condition and keeping the stress constant against various disturbances. The maximum load is 100 kg with precision of ± 0.3 kg, and the deviation of the load from the calculated value is within 1 kg. A new precise temperature controller which stabilizes the temperature within ± 0.1°C is also proposed. The tester makes it possible to obtain the load-elongation curves before the creep tests and creep curves up to the strain of 10%. On the basis of the fact that polycrystalline Fe-19Cr alloy exhibits the incubation phenomenon within the strain of 0.1%, it is suggested that the phenomenon will be found below such a small strain in some alloy systems which have not exhibited the phenomenon thus far.

A Study on Stress Corrosion Cracking of Austenitic Stainless Steel in Boiling Magnesium Chloride

Koji HASHIMOTO

Corrosion, 31 (1975), 398.

The anodic reaction within the transgranular stress corrosion crack of 18–8 stainless steel in boiling $MgCl_2$ was studied under the open circuit condition at constant tensile speeds. The entire crack sides were not passive during the crack propagation. Consequently, stress corrosion cracking (SCC) of 18–8 stainless steel in boiling $MgCl_2$ is thought to propagate under conditions similar to those for