The effect of molybdenum during isothermal decomposition of supercooled austenite is evident in the higher temperature of the $\gamma \rightarrow \alpha$ transformation. Also, with increasing amounts of molybdenum the $\gamma \rightarrow \alpha$ transformation shifts to shorter holding times, i.e., molybdenum lowers the resistance of austenite to decomposition in this transformation range.

CONCLUSIONS

1. Carbides are dissolved at the highest rate at 1200-1250°C in the first 10-15 min.

2. The critical quenching rate for steel with 3% Mo is 50 deg/min; with smaller amounts of Mo the critical rate increases.

3. Isothermal decomposition of supercooled austenite to a ferrite-carbide mixture begins with preliminary precipitation of secondary MC, which at temperatures below 850°C occurs after a certain incubation period that increases as the temperature is lowered.

4. With increasing amounts of molybdenum for 0.6 to 5% the temperature range of the diffusional $\gamma \rightarrow \alpha$ transformation shifts to higher temperatures, $M_s$ drops, and the amount of retained austenite increases.

STRUCTURAL SUPERPLASTICITY OF Ag–35% Cu–5% In ALLOY

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Alloys based on the Ag–Cu–In system are widely used in various industries as welding materials and corrosion protection coatings.

Alloys of this system preserve their two-phase structure up to the melting point [1]. Hence the present work deals with the possibility of using their superplasticity for high-temperature forming.

The Ag–35% Cu–5% In alloy studied was melted in an induction furnace under a layer of incandescent charcoal. The charge consisted of M-00k copper, Sr 999.9 silver, and IN-0 indium. To study the as-cast alloy, rods 10 mm in diameter and 200 mm long were cast. To study the hot-extruded alloy, ingots 75 mm in diameter and 40 mm long were cast. Then to produce 10-mm-diameter rods the ingots were extruded in a 600-ton press at 400°C chamber temperature and at 680–700°C ingot temperature. The mechanical properties were determined with an improved version of the R-05-type tensile testing machine at 650–700°C and at a strain rate of 0.1–30 mm/min ($\dot{\varepsilon} = 1.7 \times 10^{-4}$ to $0.5 \times 10^{-1}$ sec$^{-1}$). Heating of the standard cylindrical tensile specimens with gauge length 10 mm and diameter 4 mm was carried out in an electric tube furnace for 15 min. The size of the $\alpha$-phase particles (dark colored in the photographs) and the volumetric ratio of the phases were identified by quantitative metallography [2]. Specimens for metallographic studies were mechanically polished and then etched with a saturated aqueous solution of 90% (NH$_4$)$_2$S$_2$O$_8$ plus 10% K$_2$Cr$_2$O$_7$.

It is known that a finely dispersed structure is a necessary condition for superplasticity in a two-phase alloy. To produce a cast alloy with a finely dispersed structure, the influence of casting conditions (cooling rates) on ingot structure was studied. Cooling rates were varied from 0.15 deg/sec (crystallization in the crucible during furnace cooling) to 50 deg/sec (casting into a water-cooled mold). The mean value of cooling rate for each ingot was calculated from its cooling curve in the temperature range 950–300°C.

Metallographic analysis has shown that the cast structure of the alloy is sensitive to cooling rate (Fig. 1). With increasing cooling rate, considerable refinement of both primary crystals of the copper $\alpha$ phase and the eutectic particles occurs. Quantitative metallographic analysis of the structure of the alloy cast in a water-cooled mold has shown that this casting method promotes formation of a well-dispersed structure; however, this does not eliminate the variation of the grain size in the structure of the alloy, caused by the presence of...
two structure-building elements, i.e., primary crystals of the copper \( \alpha \) phase and eutectic (Fig. 1d, Fig. 2a). It must be mentioned that the characteristic feature of the cast structure (formation of primary phase dendrites and lamellar eutectic structure) does not depend on the casting conditions.

Since casting into a water-cooled mold produces an alloy with the most highly dispersed structure, the authors used this casting method exclusively.

During heating of a cast ingot to the temperature of mechanical testing (650-700°C), its structure does not undergo any change. Results of mechanical tests have shown (Fig. 3) that at 650°C elongation hardly changes with strain rate (0.1-1 mm/min) and is in the range 30-40\%, i.e., ranks with the high-temperature plasticity of pure as-cast silver [3].

Increase of temperature to 700°C causes a drastic increase of plasticity at strain rates in the range 0.1-0.2 mm/min. Elongation of the specimens proceeds evenly and reaches 130-190\%. This increase in high-temperature plasticity of the cast metal is apparently caused by formation of a granular structure due to dynamic recrystallization at rather low strain rates, which results in the appearance of structural superplasticity. The negative influence of the as-cast structure on development of superplastic flow is revealed not only by the relatively low values of elongation, but also by the intense development of porosity.

The results of this study showed that at high temperature the alloy possesses adequate plasticity. However, strain rates corresponding to the highest elongation values are much lower than those used in industrial practice.