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Effect of dynamic strain aging on the deformation behavior and microstructure of Cu-15Ni-8Sn alloy

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Abstract: The compression deformation behavior of the Cu-15Ni-8Sn alloy prepared by powder metallurgy was investigated under a temperature range from 300 to 573K and a strain rate range of 5×10^{-5} ~1×10^{-2} s^{-1}. The results showed that in a certain range of strain rates and temperatures, the stress-strain curve exhibited obvious serrated flows which were induced by dynamic strain aging (DSA). The activation energy calculations indicated that the DSA was mainly attributed to the interaction of Sn solute atoms with dislocations. In the microstructure of the alloy pre-deformed in the region of DSA, Sn atoms were more likely to aggregated along the slip bands and therefore resulted in the dynamic precipitation of Sn-rich phase at lower temperature than that of natural aging alloy without pre-deformation.

Key words :Cu-15Ni-8Sn alloy; serrated flow; dynamic strain aging; dynamic precipitation.

1. Introduction

Cu-15Ni-8Sn(wt.%) is a commercial alloy (designated as C72900 ASTM B740-80) and widely used in the electronic and mechanical industry due to its good electric conductivity, excellent age harden-ability and high corrosion resistance [1,2] .

The high strength of Cu-Ni-Sn alloys derives from precipitation hardening. Many studies had been performed to understand the precipitation hardening mechanism of Cu-Ni-Sn alloys [3-6]. To attain higher strength, cold rolling or drawing are usually used before aging since cold pre-deformation lead to both work hardening and acceleration of aging strengthening process. So far, researchers have not reached an agreement about the influence mechanism of pre-deformation on aging process.