Evading the strength and electrical conductivity trade-off in Cu-Ni-Si alloys by cryogenic rolling and aging

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Abstract

Copper alloys are widely recognized for their exceptional electrical and thermal conductivity. However, their relatively modest strength presents a significant hindrance to their broader application spectrum. The pursuit of enhancing the strength of copper alloys while retaining their high conductivity has emerged as a captivating focus in research. In our study, we employed cryogenic rolling followed by aging processes to craft Cu-Ni-Si alloys, characterized by deformation twins and nanosized Ni2Si phases. The incorporation of deformation twins notably heightened the alloy's strength while concurrently preserving its electrical conductivity. We conducted an exhaustive examination of the microstructure evolution of the Cu alloy during cryogenic rolling and subsequent aging. Additionally, we conducted a thorough analysis of the correlations between the acquired microstructure and the corresponding properties. The outcomes of our research offer promising strategies to overcome the inherent trade-off between strength and conductivity in advanced Cu alloys.

Keywords: Cu alloy, Deformation twinning, Cryogenic rolling, Aging, High strength

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