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Nanocrystalline CuNi alloys: improvement of mechanical properties and thermal stability JOSEP NOGUES, ICREA and Institute Catala de Nanociencia i Nanotecnologia, A. VAREA, Univeristat de Barcelona, E. PELLICER, Universitat Autonoma de Barcelona, K.M. SIVARAMAN, S. PANE, B.J. NELSON, ETH Zurich, S. SURINACH, M.D. BARO, Universitat Autonoma de Barcelona, J. SORT, ICREA and Universitat Autonoma de Barcelona — Nanocrystalline metallic films are known to benefit from novel and enhanced physical and chemical properties. In spite of these outstanding properties, nanocrystalline metals typically show relatively poor thermal stability which leads to deterioration of the properties due to grain coarsening. We have studied nanocrystalline $Cu_{1-x}Ni_x$ ($0.56 < x < 1$) thin films (3 μm-thick) electrodeposited galvanostatically onto Cu/Ti/Si (100) substrates. CuNi thin films exhibit large values of hardness ($6.15 < H < 7.21$ GPa), which can be tailored by varying the composition. However, pure Ni films ($x = 1$) suffer deterioration of their mechanical and magnetic properties after annealing during 3 h at relatively low temperatures ($T_{ANN} > 475$ K) due to significant grain growth. Interestingly, alloying Ni with Cu clearly improves the thermal stability of the material because grain coarsening is delayed due to segregation of a Cu-rich phase at grain boundaries, thus preserving both the mechanical and magnetic properties up to higher T_{ANN}.

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