

On the underlying mechanisms in binary Ni-based nanocrystalline alloys

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The hardness of binary nanocrystalline Ni-based alloys with segregating solute elements increases upon annealing until a certain temperature and then decreases beyond a critical temperature. In most of these alloys, the grain size increases only slightly while the strength increases and a jump is observed in the grain size post this critical limit. This study critically evaluates the various underlying strengthening mechanisms, including (a) the state of the solute elements at grain boundaries, (b) the formation of second phases, and (c) the role of observed twins in annealed alloys. Various alloy compositions were synthesised using a pulsed electrodeposition method. The experimental observations and analyses are examined in terms of grain boundary stability, strengthening and weakening.

Keywords: nanocrystalline binary Ni alloys ; strengthening mechanisms ; hardness; twins; solute segregation