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Size dependent alloying and plastic deformation behaviors of Ti/Ni nano-multilayers

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Abstract: Proper modulation ratio (η) and modulation period is very critical for alloying of metallic multilayers. In this work, size dependent alloying and plastic deformation behaviors of Ti/Ni nano-multilayers have been investigated by nanoindentation. It is found that the multilayers deposited at 450 °C and annealed at 600 °C have fully alloyed. Phase compositions of the alloyed multilayers strongly depend on η and massive B2-NiTi phases spring up at $\eta = 1.7$. Nanoindentation hardness of the alloyed multilayers reaches the maximum at $\eta = 1.7$ and also shows modulation ratio dependence, which mainly results from conversion of phase compositions with changing η . Indentation depth dependent hardness agrees well with the model of geometrically necessary dislocations.

Keywords: Ti/Ni multilayer; Modulation ratio; Nanoindentation; Alloying; Mechanical properties

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