

Physico-Chemical nanomaterials science

XRD in situ heating of Ni/Al reactive metallic multilayers

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Reactive metallic multilayers like Ni/Al could be applied for relatively low temperature synthesis of intermetallic compounds. The Ni/Al multilayers with the period of 33 nm (Ni - 13 nm, Al - 20 nm), 80 nm (Ni - 30 nm, Al - 50 nm) and 113 nm (Ni - 45 nm, Al - 68 nm) were deposited onto (001)-oriented monocrystalline silicon substrate using double target magnetron sputtering system equipped with rotating substrate holder [1]. The in situ heating of Ni/Al multilayers were carried out using Bruker D8 Discover diffractometer (40 kV/40 mA) with Cu anode ($\lambda = 1.5406 \text{ \AA}$) and equipped with Anton-Paar TTK 450 chamber. The sample was subjected to heating to steps every 50 °C up to 450 °C at a rate of 20 °C /min, followed by cooling to 25 °C at a rate of 30 °C /min. The transmission electron microscopy (Tecnai G2 F20, FEI Company) method was used for the microstructure observations of the “as-deposited” Ni/Al multilayers. Thin foils for TEM investigations were cut out using FEI Quanta 200 dual beam focused ion beam (FIB). Based on the phase analysis, information about the sequence of transformations during heating of reactive metallic multilayers was obtained. The differences in sequence of phase transformations are observed, analyzed and discussed.

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1. Swiatek Z., Gradys A., Maj L., Morgiel J., Marszalek K.W., Mania R. and Szlezzynger M. XRD and TEM in situ Heating of Large Period Ni/Al Multilayer Coatings // Acta Physica Polonica A, -2016. -130, No. 4, -P. 880 - 883.