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Nickel-Aluminum diffusion; A study of evolution of microstructure and phase

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Abstract:

Microstructural and phase evolution of an aluminum deposit on nickel, after heat treatment at 883 K, is studied by means of various microscopy techniques, i.e. energy dispersive X-ray spectroscopy, backscattered electron imaging, electron backscatter diffraction, ion channeling contrast imaging and scanning transmission electron microscopy. AlNi_3 crystallites are observed on the aluminum grain boundaries after only 3 min. of heat treatment indicating that nickel and nickel rich phases are the initially diffusing and forming species. Heat treatment for 120 min. or longer results in the formation of Al_3Ni_2 and a porous $\text{Al}_3\text{Ni}_2/\gamma\text{-Al}_2\text{O}_3$ structure at the surface. The Al_3Ni_2 layer is composed of two different grain morphologies, indicating the position of a Kirkendall plane, and hence, there is a high diffusion rate of aluminum in this phase.