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Hossein Alimadadi, Cecilía Kjartansdóttir, Andrew Burrows, Takeshi Kasama, Per Møller

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

Hossein Alimadadi[1,†], Cecilía Kjartansdóttir[2], Andrew Burrows[1], Takeshi Kasama[1] and Per Møller[2]

[1]Technical University of Denmark, Center for Electron Nanoscopy, Fysikvej, building 307, DK–2800 Kongens Lyngby, Denmark.

[2]Technical University of Denmark, Department of Mechanical Engineering, Produktionstorvet, building 425, DK – 2800 Kongens Lyngby, Denmark.

† Corresponding Author, E-Mail: hoal@cen.dtu.dk, Tel.: +45 45256494

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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 $Al_3Ni_2/\gamma\text{-}Al_2O_3$ 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.