

Diffusion and Solid State Reactions between Nanocrystalline Ni₂Si and Amorphous Si Thin Films

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Nanocrystalline Ni₂Si(20 nm)/amorphous Si(20 nm) system was prepared using DC magnetron sputtering. The samples were heat treated at 180°C for 1-20 hours. The depth profiles were determined by means of Secondary Neutral Mass Spectrometry. It is observed that time evolution of the solid state reaction and the morphology of the reaction layer is different from the one observed in Ni₂Si(20 nm)/crystalline Si system. In the latter case the new phase (NiSi) grew by grain boundary diffusion induced solid state reaction (GBDIREAC), with no reaction layer formation at the initial interface. In this system the process starts with Ni diffusion into a-Si resulting in a wide intermixed layer at the interface. This layer thickens in the expense of the a-Si and inside of it a definite shoulder develops with composition of NiSi₂. This leads to the impoverishment of the Ni₂Si layer in Ni. Thus the main difference between the above to systems is that the Ni diffusion is much faster in a-Si than in the c-Si and even faster than Si grain boundary diffusion in Ni₂Si.