Barrier Properties of Electroplating Nickel Layer for Copper Metallization in Silicon Solar Cells

You Ren Cheng¹, Wen Jauh Chen^{1,*}, Keisuke Ohdaira² and Koichi Higashimine²

¹ Graduate School of Materials Science, National Yunlin University of Science and Technology, Douliu, Yunlin, Taiwan.

² Japan Advanced Institute of Science and Technology, 1-1 Asahidai, Nomi, Ishikawa 923-1292, Japan.

*E-mail: chenwjau@yuntech.edu.tw

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In this work, a thin nickel layer was deposited on textured (001) silicon by an electroless plating method. The as-deposited nickel film samples were annealed at 500°C in an Ar/H₂ atmosphere for 10 min to form nickel silicide. Ni surface etching was done in HNO₃ to remove unreacted nickel. This substrate is designed as ta-Si. Afterward, the Ni layer with various thicknesses and the 1.5 μm thick Cu film were deposited on ta-Si by an electroplating technique to form the Cu/Ni/ta-Si structure. The Cu/Ni/ta-Si samples were annealed at various temperature for 10 minutes in an annealing furnace. The Cu/Ni/ta-Si samples were defined using the following: x-ray diffractometer (XRD), scanning electron microscope (SEM), and scanning transmission electron microscope (STEM). For the Cu/Ni(120 nm)/ta-Si samples, the Cu₃Si particles develop from an annealing temperature of 400°C. This revealed that electroplating a thin Ni layer can act as a diffusion barrier against Cu at around 400°C.

Keywords: Textured silicon; Electroplating; Solar cells; Diffusion barrier

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