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Spectroscopic ellipsometry of NTO/ultrathin Cu/NTO films JUN WOO PARK, HYUNG KEUN JANG, HOSUK LEE, HOSUN LEE, JUN-HYUK PARK, HAN-KI KIM, Kyung Hee University, BO HYUN KONG, HYUNG KOUN CHO, Sungkyunkwan University — NTO/Cu/NTO/glass thin films were grown using sputtering deposition. The thickness of the Cu film (t) varied between 1.5 nm and 50 nm. The ellipsometric angles (Ψ, Δ) of the NTO/Cu/NTO/glass thin films were measured by using spectroscopic ellipsometry. The thicknesses and dielectric functions of the Cu films in the NTO/Cu/NTO/glass were estimated by using a multi-layer model analysis with the parametric optical constant and Drude models. Transmission electron microscopy measurements showed that the Cu layers evolved from aggregates of Cu nanoparticles to coalesced Cu thin films as the Cu film thickness increased. According to sheet resistance data, the Cu films thinner than 8 nm were aggregations of Cu nanoparticles that were not well-connected and the Cu films thicker than 8 nm were above the percolation threshold. From the Drude model, the plasmon frequency (ω_p) and the electron relaxation time (τ) were estimated and were found to increase with increasing film thickness. We obtained the second derivatives of the dielectric function spectra that were composed of several peaks near 1.5, 2.1, 2.5, 3.5, and 4.3 eV, and attributed to interband transitions. The peak energies (except 1.5 eV) matched to the band structure calculations found in the literature.

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