Cu–Zr Thin Film Electrodeposited from an Aqueous Solution Using Rectangular Pulse Current Over a Megahertz Frequency Range

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Cu–Zr thin films electrodeposited on indium tin oxide glasses from aqueous solutions containing potassium sodium tartrate tetrahydrate using rectangular pulse current over a frequency range of 0.5–1.4 MHz were investigated. Resonant frequencies at which the Zr content in the Cu–Zr thin films was maximum were identified using energy dispersive X-ray spectroscopy. A resonant frequency interval between the neighboring resonant frequencies was 0.26 MHz on average. The resonant frequencies and resonant frequency interval were explained in terms of an energy level transition between the Fermi energy level of electron in the indium tin oxide and quantized rotational energy level of a complex ion comprising Zr and tartaric ions in the aqueous solution. X-ray diffraction analysis confirmed that the Cu–Zr thin film was an alloy composed of Cu and Zr. Surface images of the Cu–Zr thin film observed using scanning electron microscopy indicated an aggregation of cauliflower-like islands consisting of nano-scale grains.

Keywords: Zr; Cu–Zr thin film; Resonant frequency; Resonant frequency interval; Energy level transition; Cauliflower

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