Aluminium in a Cu-Mo-Al Thin Film Generated Resonantly in an Aqueous Solution using a Megahertz Rectangular Pulse Current Electrodeposition Technique

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Aluminium in a Cu-Mo-Al thin film generated on an indium tin oxide (ITO) glass substrate in an aqueous solution by a rectangular pulse current technique in a range of frequency from 0.2 to 1.5 MHz was demonstrated. The aluminium concentration in the Cu-Mo-Al thin film measured with energy dispersive X-ray spectroscopy (EDX) was observed only in the vicinity of a resonant frequency. Several resonant frequencies existed at a certain interval in the range of the frequency. The resonant frequency spacing between the neighboring resonant frequencies became about 0.2 MHz. These experimental results are discussed from a viewpoint of energy level transition between the Fermi energy of electron in an electrode and a quantized rotational energy of a cluster of a trivalent aluminium ion and divalent molybdate ion. The maximum aluminium concentration in the Cu-Mo-Al thin film was about 6 wt. %. X-ray diffraction (XRD) analysis showed that (111), (200), (220), and (311) planes well consistent with those of polycrystalline copper existed parallel to the ITO glass. The Cu-Mo-Al thin film is found to be an alloy comprising Cu, Mo, and Al. In addition, surface images of the Cu-Mo-Al thin film observed with scanning electron microscope (SEM) showed an aggregation of nano cauliflowers.

Keywords: aluminium electrodeposition; aqueous solution; megahertz; energy level transition; resonant frequency; alloy; nano cauliflower.

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