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Plasma enhanced atomic layer deposition of metal thin films

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Copper and aluminum thin films were deposited by plasma enhanced atomic layer deposition at low temperature, using copper(I)-N,N'-di-sec-butylacetamidinate ([Cu(^{s}Bu-Me-amd)]$_2$) and trimethylaluminum ($Al(CH_3)_3$) as precursor, respectively, and hydrogen as reductive gas for both deposition. Influence of temperature, plasma power, mode of plasma and pulse time on deposition rate of thin film, purity of film and step coverage were studied, feasibility of copper film deposition on inner wall of carbon fiber reinforced plastic waveguide with high aspect ratio was also studied. Morphology and composition of thin film were studied by atomic force microscope and X-ray photoelectron spectroscopy, respectively. Square resistance of thin film was also tested by four probe technique. On the basis of on-line diagnosis, a growth mechanism of thin films was put forward, it was considered that surface functional group play an important role in the process of nucleation and determined property of thin film. High density of plasma and high content of free radical were helpful for deposition of metal thin films. Copper film with high purity required by waveguides can be deposited on the inner wall of waveguides by ALD, with some contaminants of oxygen and carbon only on the surface of thin films.

Keywords
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