

[II-4]

The improvement of Cu metal film adhesion on polymer substrate by the low-power High-frequency ion thruster

Jung Cho,* Elena Kralkina, Ki Hyun Yoon* and Seok Keun Koh

Thin Film Technology Research Center, Korea Institute of Science and Technology

*Department of Ceramic Engineering, Yonsei University

The adhesion interface formation between copper and poly(ethylene terephthalate)(PET), poly(methyl methacrylate)(PMMA) and Polyimide films was treated using Ion assisted reaction system to sequential sputter deposition by High-Frequency ion source. The ion beam modification system used a new type of low power HF ion thruster for space application as new low thruster electric propulsion system. Low power HF ion thruster with diameter 100mm gives the opportunity to obtain beams of Ar⁺ with currents 20 ~ 150 mA (current density 0.5 ~ 3.5 mA/cm²) and energy 200 ~ 2500 eV at HF power level 10 ~ 150 W. Using Ar as a working gas it is possible to obtain thrust within 3 ~ 8 mN. Contact angles for untreated films were over 95° and 80° for PET, 100° for PMMA and 120° for PI samples as a condition of ion assisted reaction at the ion dose of 1×10¹⁶ ions/cm², the ion beam potential of 1.2 keV and 4 ml/min for environmental gas flow rate.

900° peel tests yielded values of 15 to 35 for PET, 18 to 40 and 12 to 36 g/min, respectively. High resolution X-ray photoelectron spectroscopy in the C1s region for Cu metal on these polymer substrates showed increases in C=O-O groups for polyimide, whereas PET and PMMA treated samples showed only C=O groups with increase the ion dose. Finally, unstable polymer surface can be changed from hydrophobic to hydrophilic formation such as C-O and C=O that were confirmed by the XPS analysis, conclusionally, the ion assisted reaction is very effective tools to attach reactive ion species to form functional groups on C-C bond chains of PET, PMMA and PI.