

[III~13]

Improving adhesion of PTFE(polytetrafluoroethylene) to metals and adhesives by keV Ar⁺ irradiation under oxygen environment

Sung-Chul Park, Chang-Kyu Choi, Jin-Woo Seok, Hyung-Jin Jung, Kook-Dong Pae,
and Seok-Keun Koh

Kim Sung Ryong*

Division of Ceramics, Korea Institute of Science and Technology,
P.O. Box 131 Cheong-ryang, Seoul, Korea

, *Samyangsa R&D center**

When PTFE was irradiated with Ar⁺ ion at 1 keV with blowing oxygen gas near the surface, the adhesion of PTFE to metals (Al and Cu) and adhesives (crystal bond and epoxy) were remarkably enhanced. In scotch tape test for the adhesion of Al (aluminum)/PTFE and Cu/PTFE, it was found that full detachment of metal films was observed when PTFE was not irradiated whereas partial or no detachment occurred when irradiated to 10¹⁵ ions/cm² without and with oxygen environment. The adhesion of PTFE to adhesives was drastically increased with Ar⁺ ion irradiation of PTFE with and without oxygen in tensile tests. XPS spectra showed decreased intensity of the F1s peak and the formation of the O1s peak at PTFE surface after the irradiation with oxygen environment. The surface of PTFE became extremely rough with increasing irradiation in SEM study. The enhancement of adhesion property of PTFE by irradiation may be attributed to the changes in the chemical structure of PTFE, the interfacial bonding and the roughness. The contact angle of water on irradiated PTFE decreased with the ion dose up to 10¹⁵ ions/cm², increased at higher dose, and finally increased to the extent that no wetting was possible at 10¹⁷ ions/cm². The increased contact angle by irradiation was not changed with time when exposed to air, but it was decreased when reserved in water. These results on wettability are in marked contrast with those observed on PC, PMMA, and PET and are probably due to the unusually high level of surface roughness of PTFE caused by Ar⁺ bombardment.