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Surface modification of polyimide by ion assisted reaction in oxygen environments

S. C. Choi, J. W. Seok, W. K. Choi, H. G. Jang, H-J. Jung and S. K. Koh

Division of Ceramics, Korea Institute of Science and Technology, P.O.Box 131
Cheongryang, Seoul, 130-650, Korea

Abstract

Polyimide films are modified by Ar^+ ion beam at 1 kV in oxygen environments. An anglemeter was used for measuring the wettabilities and surface free energies of modified polyimide films. Amounts of ions were changed from 5×10^{15} to 1×10^{17} ions/cm² and amounts of blowing oxygen from 0 to 6 sccm(ml/min). The wetting angles between water and polyimide films modified by Ar^+ ion without oxygen blowing decrease from 67 to 40 degrees and surface free energies increase from 46 to 64 dyne/cm². The wetting angle of polyimide films modified by Ar^+ ion in oxygen environments decrease to 12 degree and surface free energy increase to 72 dyne/cm². After irradiation of polyimide films by Ar^+ ion with dose of 10^{17} ions/cm² in oxygen environments were kept in dry air for 110 hours, contact angle between water and polyimide films increased to 65 degrees, while, contact angle between water and polyimide films which were kept in water increased to 46 degrees. X-ray photoelectron spectroscopy was used for analyzing the chemical changes at the surface after ion irradiation. From the x-ray photoelectron analysis, it is found that the chemical bonds between polyimide components are severed by ion irradiation and hydrophilic groups such as $-(\text{C}=\text{O})-(\text{ON})-$, COH and $(\text{C}=\text{O})-\text{C}$ are formed by the reaction between newly formed radicals and blowing oxygen.

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