PLASMA-ENHANCED POLYMER DEPOSITION IN AMBIENT ENVIRONMENT CONDITIONS USING DIELECTRIC BARRIER DISCHARGE PLASMA JET

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In this work, a polymer film deposition system based on plasma-polymerization technique is developed by using an atmospheric pressure floating electrode dielectric barrier discharge (DBD) jet, as shown in Fig. 1. Helium with small admixtures of polymer precursors is used as the working gas in the DBD system to achieve plasma polymerization. A floating electrode configuration is used to allow for an active plasma region in the vicinity of the substrate rather than just an afterglow plasma region. Initially nitrogen was used as a background gas for deposition. In using air as a background gas additional concerns are oxidation and combustion of the monomer which may affect the conditions of both the deposition and plasma. Various precursor types, precursor concentrations, discharge powers, flow rates, and electrode configurations as well as substrate materials are utilized in the experiments. The polymer films with the different growth parameters are compared and discussed by a *W/FM* value[1], where *W* is the discharge power, *F* is the precursor flow rate (precursor concentration) and *M* is the molecular weight of the polymer precursor. Preliminary works are focused on the deposition of polymethyl methacrylate (PMMA) films. The surface morphology of the polymer films is characterized by scanning electron microscopy (SEM) and atomic force microscopy (AFM). Fourier-transform infrared spectroscopy (FTIR) and X-ray photoelectron spectroscopy (XPS) are used to investigate the chemical composition of the plasma-polymerized films.

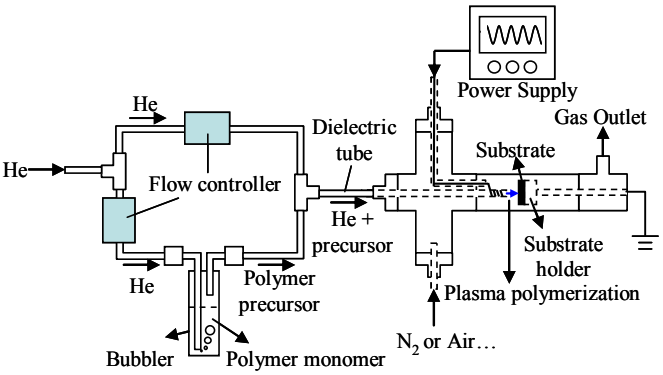

Fig. 1. Schematic diagram of the polymer deposition system by using DBD.

1. T. R. Gengenbach and H. J. Griesser, "Deposition Conditions Influence the Postdeposition Oxidation of Methyl Methacrylate Plasma Polymer Films", Journal of Polymer Science. Part A: Polymer Chemistry, Vol. 36, 1998, pp. 985-1000.