Abstract

Self-designed and fabricated dielectric barrier discharge setup is utilized to study the effect of atmospheric plasma on surface-modification of Polymethylmetacrylate (PMMA). For this purpose, PMMA was exposed to plasma at various exposure times ranging from 30 minutes to 180 minutes. The plasma was operated at fixed AC voltage of 18 kv with an average frequency of 50 Hz with spacing of 3 mm between electrodes. Optical microscopy, UV-Visible spectroscoscopy, four probe method, FTIR (Fourier Transform Infrared Spectroscopy, micro hardness tester and contact angle measurements were utilized to evaluate the surface morphology, optical, electrical, structural, mechanical and wettability modification of PMMA after plasma treatment. Surface morphology revealed the formation of pits and pores like structures whose number density were increased with increasing the treatment time. This effect is observed due to enhanced etching, sputtering, mass evaporation and bond breaking. FTIR analysis showed the appearance of $OCH_3$and rocking vibrational bond of carboxylic acid (COOH). The electrical and mechanical properties of PMMA are significantly enhanced owing to their crosslinking morphology, creation of extensive networks made up of conjugated bonds, free carriers, carbonaceous clusters and un-saturated bonds. However, a decrease in transmittance is observed near the visible region due to maximum scattering of light and red shift in optical absorption edge. Plasma treatment has also enhanced the wetting properties of PMMA due to increased surface activation and formation of oxygen-containing polar groups while making PMMA a hydrophilic polymer.