OR0901

Control of Film Density and Porosity of Functional Plasma Polymers

Dirk Hegemann[1], Johannes Drosten[1], Barbara Hanselmann[1], Martin Drabik[1], Enrico Körner[1]

[1]Empa, St.Gallen, Switzerland

dirk.hegemann@empa.ch

Plasma polymer films are distinguished by their chemical composition, functionality, and film density. The latter is determined by crosslinking and amount of terminal groups. Thus, plasma polymers cover a broad range from polymer-like, functional (e.g. hydrophilic or hydrophobic) up to dense barrier coatings. The formation of the plasma polymers is based on multistep reactions that are taking place both in the gas phase and on the surface. In order to gain more insights and to control plasma polymerization processes, some assumptions can be made that allow a macroscopic approach. Therefore, a concept was developed based on the energy input both into the gas phase (plasma) and during film growth (surface). Different reactor geometries were used covering a broad parameter range concerning power input *W* and gas flow *F*. The reaction parameter *W*/*F* (specific energy) was examined as the energy input per monomer in the plasma. By measuring excitation voltage of the RF discharge and electron density, the mean ion energy and the ion flux arriving at the substrate surface can be estimated yielding the energy density dissipated during film growth, i.e. energy flux per deposition rate. Control of both parameters is required to adjust film density and porosity of functional plasma polymers. Therefore, NH_3/C_2H_4, HMDSO, and O_2/HMDSO gas discharges were investigated to obtain amino-functional, hydrophobic or barrier coatings. Deposition rates and film densities were recorded beside chemical composition. The type of plasma chemical reactions is determined by an activation barrier, while the (important) *eedf* rather has an impact on the number of reactions leading to film-forming species. The film density was found to be mainly depending on energy density during film growth allowing dense barrier coatings or nano porous functional coatings. Such coatings were deposited on Ag films in order to adjust the Ag^+ ion release in aqueous environments.

Keywords
RF plasma
energy input
permeation
ion release