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Chemical Structure of Plasma-Polymerized Organosilicones by FTIR

Martin Bránecký, Vladimír Čech

FCH, Brno University of Technology, Brno, Czech Republic

xcbranecky@fch.vut.cz

Thin films in a form of plasma polymers can be prepared from organosilicon monomers using plasma-enhanced chemical vapor deposition (PECVD). In this study, the pure tetravinylsilane (TVS) monomer and mixture of TVS with oxygen (O_2) or argon (Ar) gas were used for deposition of thin films using power ranging from 2 W up to 150 W. The deposited material prepared from the pure TVS or TVS/Ar mixture was hydrogenated amorphous carbon-silicon (a-SiC:H). On other hand the deposited material prepared from the TVS/O_2 mixture was hydrogenated amorphous carbon-oxygen-silicon (a-SiOC:H). The thickness of thin films was about 700 nm. The chemical structure of plasma polymers was examined by Fourier-transform infrared (FTIR) spectroscopy (VERTEX 80V, Bruker Optics), which was working under vacuum in a range of wavenumber from 4000 cm^{-1} to 400 cm^{-1}. Chemical structure of plasma polymer films was evaluated using FTIR spectra as a function of power and monomer/gas mixture. For example, the absorption bands in range from 3000 cm^{-1} to 2800 cm^{-1}, assigned to CH_2 and CH_3 vibrations, had a decreasing trend with enhanced power for all the mixtures. This development can be explained by increasing level of dissociation of hydrogen from the TVS molecule with enhanced power during the plasma process. Characterization of plasma species by mass spectrometry can help to analyze changes in chemical structure of deposited films. Therefore, the deposition chamber was equipped by mass spectrometer (Process Gas Analyser HPR-30, Hiden Analytical) to evaluate the fragments of monomer/gas molecules for different deposition conditions.

Keywords
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