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Functionalization of organosilicate thin films by catalytic reaction using Microwave-excited Plasma

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Organosilicate film such as polysilsesquioxanes can be used as a low dielectric material or an optical coating due to its low electron density, low dielectric constant and low refractive index. Also, they can be used as a base bottom layer to form nano-structure patterns using block copolymers. To make an aligned line patterns using block copolymers, it need to control surface energy of organosilicate films. Previously, modification of surface energy of organosilicate films by changing curing temperature and time is reported.

In this study, we developed a new method to control surface energy of organosilicate films using microwave-excited plasma treatment. By catalytic reaction between films and excited species like radicals and ions, chemical structure was changed. By breaking chemical bonds specially Si-CH₃ bonds and forming Si-OH groups, hydrophobicity of organosilicate films decreased by increasing exposure time and decreasing a distance between plasma outlet and film surface. Hydrophobicity of films was measured and compared by water contact angles. And chemical structural changes before and after plasma treatment were measured using Fourier-Transform Infrared (FT-IR) spectroscopy. Surface morphology after plasma treatment was also confirmed by using an Atomic Force Microscopy (AFM) and a Scanning Electron Microscopy (SEM).

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