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Hydrophillic and Hydrophobic Properties of Sol-Gel Processed Sillica Coating Layers

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The control of wettability of thin films is of great importance and its success surely brings us huge applications such as self-cleaning, antifogging and bio-passive treatments. Usually, the control is accomplished by modifying either surface energy or surface topography of films. In general, hydrophobic surface can be produced by coating low surface energy materials such as fluoropolymer or by increasing surface roughness. In contrast, to enhance the hydrophillicity of solid surfaces, high surface energy and smoothness are required.

Silica (SiO2) is environmentally safe, harmless to human body and excellently inert to most chemicals. Also its chemical composition is made up of the most abundant elements on the earth's crest, which means that SiO2 is inherently economical in synthesis. Moreover, modification in chemistry of SiO2 into various inorganic-organic hybrid materials and synthesis of films are easily undertaken with the sol-gel process.

The contact angle of water on a flat silica surface on which the Young's equation operates shows ~50o. This is a slightly hydrophilic surface. Many attempts have been made to enhance hydrophilicity of silica surfaces. In recent years, superhydrophilic and antireflective coatings of silica were fabricated from silica nanoparticles and polyelectrolytes via a layer-by-layer assembly and post-calcination treatment. This coating layer has a high transmittance value of 97.1% and a short water spread time to flat of <0.5 s, indicating that both antireflective and superhydrophilic functions were realized on the silica surfaces.

In this study, we assessed hydrophillicity and hydrophobicity of silica coating layers that were synthesized using the sol-gel process. Systematic changes of processing parameters greatly influence their surface properties.

Keywords: hydrophillicity, hydrophobicity, silica, coating, sol-gel