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Wettability of Superhydrophobic Polymer Layers Filled with Hydrophobized Silica on Glass

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Abstract : Superhydrophobic surfaces exhibit extremely high water repellency. The commonly accepted basic criterion for such surfaces is a water contact angle larger than 150°, low contact angle hysteresis and low sliding angle. These surfaces are of special interest, because properties such as anti-sticking, anti-contamination and self-cleaning are expected. These properties are attractive for many applications such as anti-sticking of snow for antennas and windows, anti-biofouling paints for boats, waterproof clothing, self-cleaning windshields for automobiles, dust-free coatings or metal refining. The various methods for the preparation of superhydrophobic surfaces since last two decades have been reported, such as phase separation, electrochemical deposition, template method, plasma method, chemical vapor deposition, wet chemical reaction, sol-gel processing, lithography and so on. The aim of the study was to investigate the influence of modified colloidal silica, used as a filler, on the hydrophobicity of the polymer film deposited on the glass support activated with plasma. On prepared surfaces water advancing (ΘA) and receding (ΘR) contact angles were measured and then their total apparent surface free energy was determined using the contact angle hysteresis approach (CAH). The structures of deposited films were observed with the help of an optical microscope. Topographies of selected films were also determined using an optical profilometer. It was found that plasma treatment influence glass surface wetting and energetic properties that is observed in higher adhesion between polymer/filler film and glass support. Using the colloidal silica particles as a filler for the polymer thin film deposited on the glass support, it is possible to produce strongly adhering layers of superhydrophobic properties. The best superhydrophobic properties were obtained for surfaces of the film glass/polimer + modified silica covered in 89 and 100%. The advancing contact angle measured on these surfaces amounts above 150° that leads to under 2 mJ/m2 value of the apparent surface free energy. Such films may have many practical applications, among others, as dust-free coatings or anticorrosion protection.

Keywords : contact angle, plasma, superhydrophobic, surface free energy
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