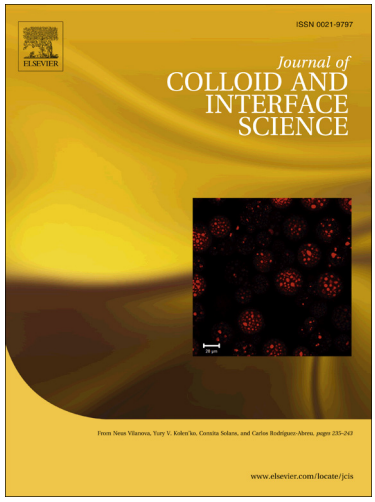

A versatile route to polymer-reinforced, broadband antireflective and superhydrophobic thin films without high-temperature treatment

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A versatile route to polymer-reinforced, broadband antireflective and superhydrophobic thin films without high-temperature treatment

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Abstract

Broadband high transmittance, good mechanical robustness as well as simple and low temperature fabrication are three important aspects that dictate the practical applications of superhydrophobic thin films, especially on organic substrates. However, it has proved difficult to meet these challenges. In the present work, superhydrophobic thin films were prepared by first dip-coating solid silica nanoparticles, then spray-coating hollow silica nanoparticles, followed by spray-coating mesoporous silica nanosheets & poly(vinyl alcohol) (PVA), and eventually chemical vapor deposition of 1H,1H,2H,2H-perflurooctyltriethoxysilane (POTS) at 90^{o}C. The optimized thin film has a maximum transmittance of 96.0% in the wavelength range of 300-2500 nm and a WCA of 164^{o} and a RA of 1^{o}. The thin film also shows good mechanical robustness toward water droplet impact test, sand impact abrasion test and tape adhesion tests, which results from PVA as a binder, the formation of covalent bond between the hydroxyl group of PVA and the ethoxy group of POTS and the chemical inertness of C-C, C-F bonds of POTS molecules. To our best knowledge, it is the first example where antireflective and superhydrophobic thin films of excellent mechanical robustness were realized at low temperature on organic