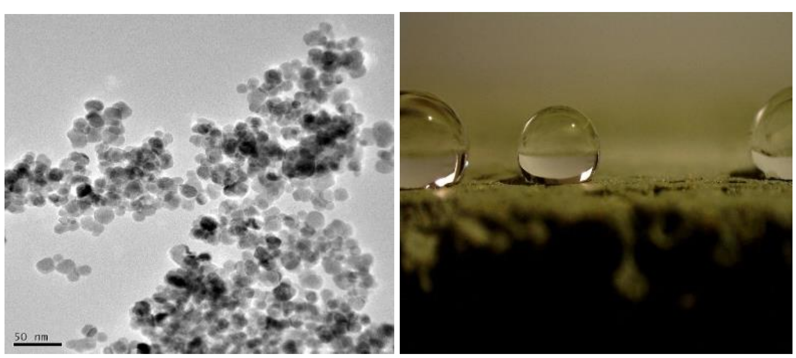
Hydrophobic Cement Blocks Based on Silica Nanoparticles

Majid S. Al-Ruqeishi, Tariq Mohiuddin, Al Mutasim Al-Zakwani
Department of Physics, College of Science, Sultan Qaboos University, P.O. Box 36, P.C. 123, Al-Khoudh, Oman

Abstract

Silica nanoparticles are widely used due to their exceptional properties such as, low conductivity, high melting point, insulator behavior and hydrophobicity. Hydrophobic surfaces have potential for implementation into a variety of fields, including self-cleaning surfaces, anti-fogging transparent materials, and biomedical applications. In this study, silica nanoparticles were employed to change intrinsically the wettability nature of cement blocks. To repel water, material with such a property can be exploited on surfaces of buildings near high humidity areas like coastline or even in the inner side of water pipelines or for water/oil separation. The effects of these surface modifications were characterized by water contact angles (WCAs), surface wetting stability, surface morphology and roughness. Surface gain hydrophobic nature when water droplet contact angles makes more than 90° with it, WCA, $\boldsymbol{\theta}$>90°. Initially, glass slides were used as pre-testing surfaces before cement block treatments. The results confirm that the concentrations of prepared silica nanoparticles and coating sprayer time played a major role to modify the glass slides surfaces hydrophobicity. The resultant SEM images and EDX spectrum show silica nanoparticles in big clusters with high coarseness surface and this can be contributed to the accumulation and aggregation of nanoparticles within the prepared solution. While under TEM analyzation, silica NPs were spherical in shape with a diameter ranges between (5-18 ± 1) nm. Resultant WCAs for cement block are 135°>$\boldsymbol{\theta}$>90°, which make water runs off easily without further cleaning.



Left, TEM image of silica nanoparticles (right) water droplets on a hydrophobic cement block.

Keywords: hydrophobic surfaces, Contact angle, Self-cleaning, silica nanoparticles