This suggests that these films do not show similar properties as bulk glass of the same composition, according to the researchers. More than one fundamental type of intergranular film forms on alumina grain boundaries and promotes diffusional transport, they said.

JOAN J. CARVAJAL

Lotus-Like Superhydrophobic Surfaces Produced from Metal-Salt Precursors

Generally, superhydrophobic surfaces have water contact angles larger than 150°. In nature, this unusual characteristic is observed on lotus and rice leaves. Artificial superhydrophobicity is generally realized after mechanical roughening or lowering of the surface energy by chemical methods. Typically, these methods require expensive materials or are time-consuming. Recently, S. Chen, C. Hu, L. Chen, and N. Xu of the College of Chemistry and Chemical Engineering at Nanjing University of Technology in Nanjing, China have reported a simple method to produce superhydrophobic surfaces using inexpensive metal alkanethiolates. In their publication in a recent issue of *Chemical Communications* (p. 1919; DOI: 10.1039/ b700994a), the researchers suggest their method produces surfaces that mimic the natural superhydrophobicity of lotus leaves.

The superhydrophobic surfaces were produced by reacting metal salts with alkanethiols. The alkanethiols consist of low surface energy, long chain alkyl groups. Initially, metal salts (cadmium or zinc) were directly reacted with *n*-dodecanethiol (1:2 molar ratio) to produce metal dithiolates with yields >95%. The resulting metal dodecanethiolate thin film (50 µm thick) was dried overnight after evaporation of ethanol at 25°C. Hydrophobicity was observed after the reaction was completed. Scanning electron microscopy (SEM), x-ray diffraction (XRD), and water contact angle (CA) measurements were performed on the samples.

SEM analysis showed the cadmium dodecanethiolate film surface consisted of flower-like spheres ranging from 5–37 µm in diameter. Individual spheres were composed of a number of microrods with average diameters of ~200 nm. The cadmium dodecanethiolate surface morphology is similar to natural lotus-like micro- and nano-hierarchical structures, which are related to the structure of the cadmium-salt precursor. XRD analysis demonstrates the cadmium dodecanethiolate films form highly crystalline, layered structures. Wetting experiments result in water CAs of 154° and 153° for (cadmium, zinc) dodecanethiolate films, respectively. The zinc dodecanethiolate films possessed a leaf-like pattern that is related to the zinc-salt precursor with diameters ranging over 2.5–5.0 µm. The researchers said their method is a convenient, inexpensive approach for producing superhydrophobic surfaces with rough hierarchical micro/ nanostructures. Chen and co-workers said this technique may also be applicable for self-cleaning surfaces.

JEREMIAH T. ABIADE

Probabilistic Model Describes Clogging During Filtration of Non-Colloidal Suspensions

The flow of suspensions through filters and porous structures—such as in liquid purification and drilling well productivity—is of importance to industry and the environment. However, the filtration of these suspensions needs a model that can be applied to a multitude of situations. According to N. Roussel and T.L.H. Nguyen of LCPC and P. Coussot of Institut Navier, both in Paris, "clogging is basically a matter of the probability of the presence of particles. We describe this process as a function of the main variables, namely, the ratio of particle to mesh-hole diameter (D), the ratio of solid to sample volume (φ), and the number of suspensions arriving at each filter mesh-hole (N_e), which might serve as a general basis for modeling filtration in any situation." However, the function they devised is also dependent on the flow characteristics of the fluids suspending the particles, which is a complex process as shown with the difficulty in reproducibility of experimental data under certain conditions. In the March 16 issue of *Physical Review Letters* (#114502; DOI: 10.1103/ PhysRevLett.98.114502), the researchers compared experimental data with their mathematical model for various suspensions containing non-colloidal particles with diameters (d_0) smaller than the various mesh-hole diameters (d) for each case, that is, $D = d/d_0 > 1$.

In addition to varying D, experiments were performed by varying φ and sample volume independently. The suspensions consisted of glass beads in a fluid of either a viscoplastic gel or a Newtonian glycerol. The resulting filter residue (R) resulting from the flow of the suspensions through the mesh filter varied from 0 to 100% as φ increased or D decreased. In all cases, there existed a region of large residues ($R \approx 100\%$) and a region of small residues ($R \approx 0\%$) with an abrupt transition around a critical ratio, $D_c = (d/d_0)_c$. Again, in all cases, D_c was significantly larger than 1 due to the formation of particle arches or bridges reflecting the probabilistic aspect of the process, which has also been observed in previous work.

The researchers made various assumptions and simplifications to this complex process and use probability to devise their model stating, "A clogging event requires that the particles be sufficiently close to each other and, thus, is more probable when φ is larger." Thus, the model predicts that, if a sufficient number of particles are simultaneously present at a filter mesh hole, clogging can occur even for non-colloidal particles that have a diameter significantly smaller than the mesh opening. The researchers show that the clogging events can encompass a variety of arch and bridge formations involving 2, 3, 4, or more particles. Also for a constant φ, clogging is more probable when the sample volume increases, thus increasing N_e. Their mathematical model and experimental data are in excellent agreement around the extremes for R, but when R is significantly different from 0 or 100%, the prediction of the model is insufficient due to the probabilistic character of the process and the complex nature of the flow characteristics. The research team is doing further investigations to support this work.

THAD AWEEKA

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