

Thermodynamics, Swell Magnitude, and Optical Properties of Swellable Organically Modified Silica

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Swellable organically modified silica (SOMS) is a hybrid organic/inorganic media discovered at the College of Wooster. Sometimes called "swellable glass," this hydrophobic material absorbs many times its mass in organic liquids like acetone (Figure 1).

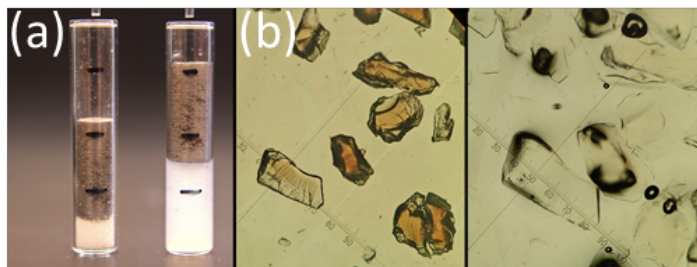


Figure 1. (a) A sample of SOMS lifting a steel weight before and after being swollen with acetone. (b) Optical microscope images of SOMS before and after being swollen with acetone.

We have [published a paper](#) on measuring and mathematically modeling the swelling of SOMS. However, the fundamental chemical and physical principles that govern its behavior are poorly understood. Thus, we are interested in measuring:

Enthalpy of swelling. Calorimetric experiments establish that the enthalpy change associated with the swelling of SOMS differs in magnitude according to the identity of the solvent. These preliminary results imply that microscopic and/or molecular-scale phenomena at the liquid-solid interface govern the release of the potential energy stored with dry SOMS.

Magnitude of swelling. Different solvents appear to make SOMS swell to a differing degree. As with the calorimetry experiments, this result implies that the swelling is dependent upon fundamental solid-liquid interactions.

Optical properties of swollen SOMS. Swollen SOMS has different opacity, and sometimes slightly different color, according to the identity of the solvent (Figure 2). In some cases, the swollen SOMS becomes completely invisible. This surprising phenomenon may be due to refractive index matching, but nobody has yet examined it systematically.

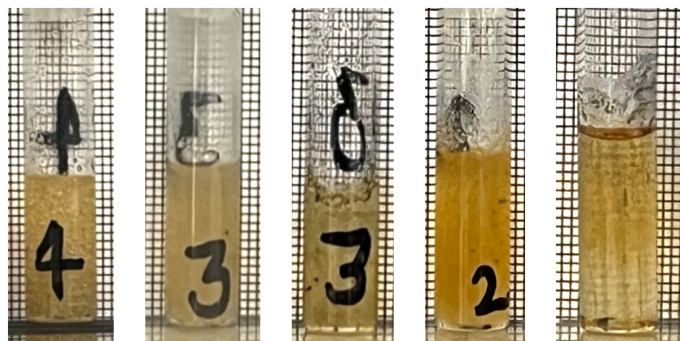


Figure 2. Samples of SOMS swollen with, from left to right: mineral oil, decane, benzyl alcohol, chloroform, and o-dichlorobenzene.

Efforts are underway to relate these observations to the Hildebrand and/or Hansen solubility parameters of the solvents and thus establish those parameters for SOMS itself. Predictive information about the selective adsorption of different substrates by SOMS enhances its potential for biological and environmental applications.