Liquid infiltration and air trapping into hydrophobic nanocavities

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The infiltration of water and various organic liquids into hydrophobic nanocavities (~20 nm wide and 100-160 nm deep) is studied using transmission small angle x-ray scattering. The results indicate that the infiltration depends on the liquid surface tension and wetting contact angle. Furthermore, a significant amount of air remains trapped into the cavities, regardless of the liquid's wetting angle. The volume of the resulting nanobubbles is compared to a simple model where the liquid capillary pressure is balanced by the bubble internal pressure. The importance of microscopic effects such as contact line pinning and disjoining pressure is also discussed.