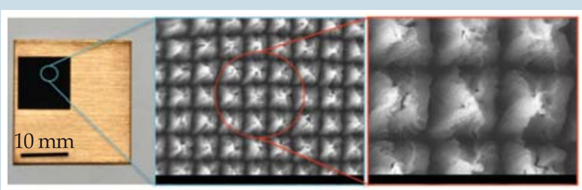
Damaged, porous materials: A salty tale. Many otherwise beautiful edifices and works of art constructed from porous materials wear the scars of salt damage. The Sagrario Chapel in Granada, Spain, part of which is shown in the figure, is one example. Salt water settles inside pores and can become supersaturated as it cools or as the water evaporates. When salts from the supersaturated solution precipitate, pressures associated with frustrated crystal growth create large, damaging forces on the pore walls. The evaporation route to supersaturation has heretofore not been much studied, but a team from the University of Granada, led by Carlos Rodriguez-Navarro, has now investigated in detail the evaporation of a confined sodium sulfate solution. Calorimetry and x-ray diffraction revealed that the sodium salt—responsible for much real-world damage—initially exists in solution as a metastable heptahydrate ($Na_2SO_4 \cdot 7H_2O$) but undergoes a phase transition to less-soluble, stable mirabilite ($Na_2SO_4 \cdot 10H_2O$) as evaporation proceeds; the result is a highly supersaturated solution. Analytic techniques allowed the Granada team to determine the mirabilite concentration and calculate the damaging strength of its crystallization pressure. In a follow-up experiment, Rodriguez-Navarro and colleagues added a compound to the initial salt solution to promote the early crystallization of mirabilite and mitigate supersaturation. Thanks to the additive, the precipitation pressure was not enough to damage most building materials. (M. Schiro, E. Ruiz-Agudo, C. Rodriguez-Navarro, *Phys. Rev. Lett.* **109**, 265503, 2012.) —SKB

Taking the shine off copper. Amin Abdolvand and his collaborators at the University of Dundee in the UK have discovered that intense nanosecond pulses of laser light can transform copper's characteristically lustrous surface to a deep, absorbent black. Although the Dundee team conducted its experiments in air, oxidation or some other chemical reaction is not the transformation's principal cause. Rather, the pulses modified the surface's vertical structure through laser-induced melting and ablation. Achieving the effect depends on how the pulses are delivered. Abdolvand and his colleagues used a neodymium-doped yttrium orthovanadate laser, which emitted 12-ns pulses at a repetition rate of 30 kHz. When focused on the Cu surface, each pulse delivered 2.6 J/cm^2 to a spot about 60 µm wide. Stepping the beam over the surface ensured that the modification took the form of discrete patches arranged in a closely spaced grid. As the accompanying figure shows, the modified surface resembled an upturned egg carton whose pyramidal cups have been pushed in. Of the various firing patterns that Abdolvand and his colleagues tested, a square grid with a spatial period of 70 µm yielded the biggest change: Reflectivity from the UV through to the red was reduced from 90% to 3% and in the near-IR from 80% to 30%. Several mechanisms can account for the absorption boost, including light-trapping in the microcavities between the pyramids. Adding strong thermal absorbance to Cu's already strong thermal conductance could find uses in devices that carry away radiant heat. (G. Tang, A. C. Hourd, A. Abdolvand, *Appl. Phys. Lett.* **101**, 231902, 2012.) —CD



The many facets of "cubic ice." In water's notoriously complex phase diagram, a solid phase commonly known as "cubic ice" or "ice I_c" is frequently encountered in various transitions between liquid, gaseous, and other solid phases. It has been seen, for example, in crystals nucleated out of supercooled water, in cirrus clouds and contrails in the atmosphere, and in the dissociation of gas hydrates. But the phase is metastable, decaying with time and temperature to the more familiar hexagonal ice, ice I_h. Moreover, the phase is not truly cubic. Instead of having an ordered arrangement of two-dimensional layers, the phase is replete with stacking faults, and crystals formed via different routes have different degrees of disorder. Werner Kuhs and colleagues at the University of Göttingen and the Institut Laue-Langevin now show that the stacking order is more complex than previously reported: It is governed by topological preferences between nearest and next-nearest neighboring layers, and a satisfactory description of the disorder requires four parameters. Such a description applies to all the different forms of ice I_c, and the parameter values constitute a reproducible fingerprint for the formation route. In addition, the researchers show that stacking faults introduce kinks in the surface of ice I_c crystals, and the resulting roughness can considerably affect chemical reactivity and other physical properties. There is as yet no evidence that hexagonal ice forms below roughly 190 K, so stacking-disordered cubic ice, say the researchers, must be what is typically encountered not just in our atmosphere—in noctilucent clouds, for example—but around other planets as well. A better understanding of the disorder thus should have significant implications for atmospheric and planetary sciences. (W. F. Kuhs et al., *Proc. Natl. Acad. Sci. USA* **109**, 21259, 2012.) —RJF