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Anti-iridescent colloidal photonic nanostructure from thermal gradients and polymeric brush effects. SEUNG YEOL LEE, HYOUNGSOO KIM, SHIN-HYUN KIM, Korea Advanced Institute of Science and Technology, HOWARD STONE, Princeton University — Colloidal nanostructures induced by self-assembly are important in reflective displays, plasmonic or photonic sensors, and color pigments. During the evaporation of droplets of colloidal suspension, due to the non-uniform evaporation rate along the droplet interface, a radially outward flow is created and it carries colloidal particles to the pinned contact line of the droplet. We document that the packing at the contact line is a face-center-cubic (fcc) colloidal nanostructure in a ring shape. The fcc structure of the colloidal nanoparticles exhibits angle-dependent color. In particular, we introduce a novel method to suppress the familiar coffee-ring effect and modify colloidal nanostructures to exhibit angle-independent optical properties. A suspension of polyethylene oxide (PEO)-coated silica nanoparticles dispersed in ethanol-water mixture is prepared. The droplet containing the nanoparticles dries on a heated substrate, which creates a thermal gradient along the interface of the droplet. This thermal gradient induces thermal-Marangoni stresses that suppress the coffee-ring effects. PEO adsorbed on the surface of silica nanoparticles produces an additional interaction between colloidal nanoparticles, which makes the final structure disordered. The disordered photonic nanostructures in our experiments exhibit angle-independent structural color. This technique can be applied to printing or optical filtering systems.

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