

Controlling nanostructuration in 2D surfaces to tailor color, matte finish and iridescence

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Appearance in 2D surfaces can be designed by controlling the morphology, composition and spatial arrangement of resonant particles and layers, creating new optical effects, such as diffuse iridescence and diffuse halos.¹ For example, stratified surfaces decorated with silver nanoparticles can be particularly interesting for scattering light in the visible range, yielding angle-dependent coloration. The plasmonic resonance of these particles can hybridize with the Fabry-Perot resonances of the thin films, creating vivid and unique color transitions, as well as a resilience to polydispersity defects.² Thus, robust optical effects are achieved on a large scale. The color of the substrate, at relatively low silver nanoparticle densities, depends solely upon Fabry-Perot resonances. The matte/glossy appearance can be tuned independently of the color by varying the density of plasmonic resonators on the surface.

Correlation in disordered surfaces provides an additional means for tuning optical appearance. We can create perforated silica surfaces with correlated disorder.³ The perforation diameter and the density of these resonant cavities can be tuned by varying the experimental parameters. We are currently experimenting with the chemical nature, and thus the refractive index, of an intermediate layer between the perforations and the substrate, as well as with curved surfaces. The optical results for these materials emphasize how material design can be exploited to manipulate multiple aspects of a surface's appearance.

References

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