

Janus Microspheres with Plasmonic Colors designed from Pickering-Emulsion Templates

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Plasmonic structures have been mostly built on flat surfaces by conventional lithographic methods—e-beam or colloidal lithographies. Here, we design a microsphere with plasmonic colors on its hemisphere by combining Pickering-emulsion templates with metal deposition. Pickering emulsions are of great importance for pragmatic and functional particles, but they have been unexplored in a field of optics. They are designed to have a nanodimple array on the microsphere surface and metal is directionally deposited to generate optical properties. Metal builds a continuous film with periodic pores on the outermost hemispherical surface and metal bowls inside the dimples, which yields a strong plasmonic resonance in the visible range, developing plasmonic colors. The plasmonic colors can be tuned by the dimple size and periodicity as well as metal type and thickness. Photonic properties from photonic bandgap are also incorporated with the as-mentioned plasmonic microspheres by raising the particle volume fraction inside the emulsion in the first place. The orientation of the Janus microspheres is controllable with an external electric field, potentially serving as active color pixels.