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Femtosecond Laser Induced Underwater Superoleophobic Surfaces

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Femtosecond laser microfabrication has been recently utilized in interface science to modify the liquid wettability of solid surfaces. Silicon surface with hierarchical micro/nanostructure is fabricated by a femtosecond laser. Similar to the fish's scales, the laser-induced surface shows superhydrophilicity in air and superoleophobicity underwater. The oil contact angles can reach up to 159.4 ± 1° for the 1,2-dichloroethane droplets in water. Besides, the surface exhibits ultralow oil-adhesion. In the oil/water/solid three-phase system, water can be trapped in the hierarchical rough structure and forms a repulsive oil layer according to underwater Cassie's theory. The contact area between the as-prepared surface and oil droplet is significantly reduced, resulting in superoleophobicity and ultralow oil-adhesion in water. In addition, transparent underwater superoleophobic and anti-oil surfaces are achieved on silica glass surfaces by femtosecond laser ablation. This transparent property is attributed to the presence of the water environment because scattering and refraction are effectively weakened. The presented method is simple and can accurately control the processing location, which may have widely potential applications in, for instance, microfluidics, biotechnologies, and antifouling coatings.

References

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