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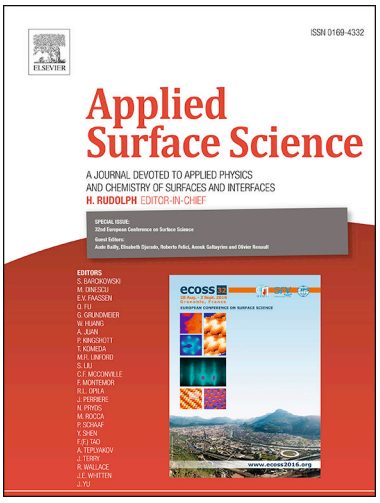

Full Length Article

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Facile one-step construction of covalently networked, self-healable, and transparent superhydrophobic composite films

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Abstract

Despite the considerable demand for bioinspired superhydrophobic surfaces with highly transparent, self-cleaning, and self-healable properties, a facile and scalable fabrication method for multifunctional superhydrophobic films with strong chemical networks has rarely been established. Here, we report a rationally designed facile one-step construction of covalently networked, transparent, self-cleaning, and self-healable superhydrophobic films via a one-step preparation and single-reaction process of multi-components. As coating materials for achieving the one-step fabrication of multifunctional superhydrophobic films, we included two different sizes of Al_2O_3 nanoparticles for hierarchical micro/nano dual-scale structures and transparent films, fluoroalkylsilane for both low surface energy and covalent binding functions, and aluminum nitrate for aluminum oxide networked films. On the basis of stability tests for the robust film composition, the optimized, covalently linked superhydrophobic composite films with a high water contact angle (>160°) and low sliding angle (< 1°) showed excellent thermal stability (up to 400 °C), transparency (≈ 80%), self-healing, self-cleaning, and waterproof abilities. Therefore, the rationally designed, covalently networked superhydrophobic composite films, fabricated via a one-step solution-based process, can be further utilized for various optical and optoelectronic applications.