

基于飞秒激光的高可靠性防污自清洁表面结构与机理研究

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通过后化学改性制备的开放式微结构超疏水表面, 在实际应用中面临着寿命短、稳定性差、易磨损破坏等难题。基于封闭式坑类结构在耐磨耐腐蚀方面的可靠性, 本工作通过飞秒激光在氧化铝表面制备了具有超疏水、耐磨防污等性能的多级坑状结构。该表面呈现出明显的时间依赖性润湿行为, 约11天后达到稳定的自适应疏水性, 并且在不同成分液体测试下均表现出优异的超疏水和自清洁性能。通过合理设计多级阶梯的级数、边界及其分布, 样品表面除了能够利用结构带来的粗糙度外, 还能够充分地发挥结构优势, 充分地利用气孔分割效应和微纳结构作用, 表现出高于Cassie-Baxter理论模型的疏水性能。这些结果为制备无需任何化学改性而具有长寿命和优秀耐磨防污性能的多功能表面提供了参考。

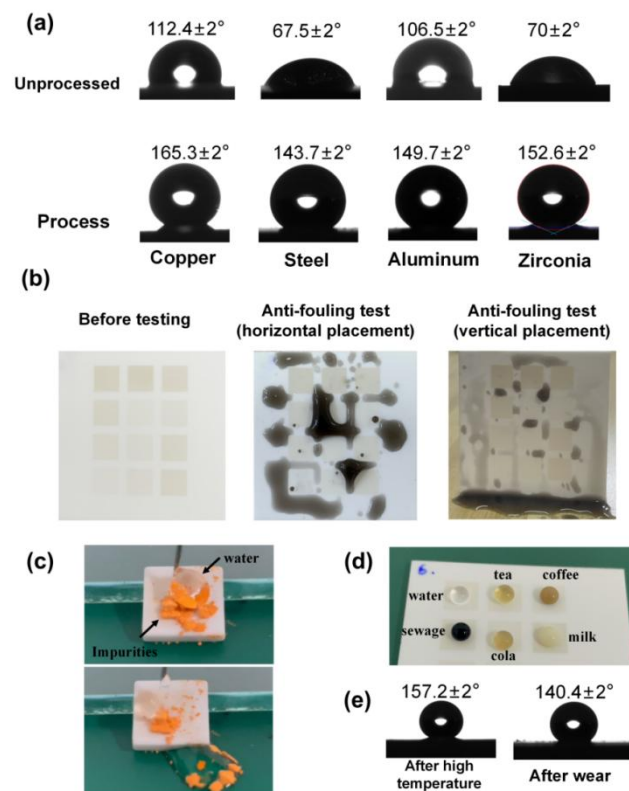


Fig. 1 (a) Before and after variation of contact angle for different material processing; (b) Anti-contamination testing of samples with different placement orientations; (c) Anti-pollution/self-cleaning test with different orientation placement; (d) Actual hydrophobicity test for different liquids; (e) Contact angle of droplets on the surface after high temperature and wear in processing sample.

关键词: 飞秒激光; 氧化铝陶瓷; 超疏水; 防污/自清洁

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