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Preparation of superhydrophobic and anti-resin-adhesive surfaces with micro/nanoscale structures on high-speed steel via laser processing

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Abstract:

In order to solve problems of high viscous resin adhering on machine or tool surfaces in manufacturing of resin based composites, a superhydrophobic and anti-adhesive surface was prepared and investigated. Micro/nanoscale hierarchical structures in shape of volcanic vents were fabricated on high-speed steel surfaces via laser processing. After being hydrophobized by fluoroalkylsilane solution, the microprotruding surfaces showed great hydrophobicity and even superhydrophobicity, with a water contact angle of 157.2° and sliding angle of 2.8°. Besides, the surfaces also displayed low wettability and excellent anti-adhesivity for highly viscous epoxy resin, with a best resin contact angle of 149.7° and sliding angle of 7.3°. As microprotruding diameters and spacings decreased from 500 to 100 μm, and heights rose from 14 to 54 μm, both water and resin contact angles increased while sliding angles decreased. The decrease of microprotruding diameter and spacing as well as the raise of height could increase surface roughness, enlarge air-liquid interface fraction and reduce actual contact area between liquid and the steel surface. Thus the wetting mode of the microstructured surface changed from