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EXPERIMENTAL PARAMETERS ON SUPERHYDROPHOBIC PROPERTIES OF CARBON NANOTUBES FOR OIL REMOVAL

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Consuming water contaminated with oil can be hazardous to human health. Removing oil from water sources ensures the safety of drinking water supplies and protects communities from potential health hazards. Efficient oil removal techniques have become increasingly critical in mitigating negative impacts of oil spills on both natural ecosystems and human societies. Vertically aligned carbon nanotubes (VA-CNTs) have exhibited promise as efficient materials for oil separation owing to their distinctive structural and chemical attributes. VA-CNTs were successfully synthesized through a novel single-zone floating catalyst chemical vapor deposition (SS-FCCVD) method using camphor/ferrocene precursor systems at 850 ºC. The contact angle (CA) measurements were also made to investigate the surface wetting property of CNTs grown on *p*-type Si(100) at different camphor loadings (17.0 g, 12.8 g and 8.5 g), while keeping the camphor/ferrocene ratio fixed at 20:1. Use of high mass of camphor (17.0 g) results in more rapidly generated and randomly entangled CNTs on the silicon substrate. The CNT surface is hydrophobic with its CA of 83º. As judged by the CA values with decreasing the mass of camphor, as-prepared CNTs are super-hydrophobic exhibiting a CA of 148-154º. Super-hydrophobic characteristics of surfaces can be obtained due to the quality of characters that may increase when the carbon source is reduced. The surface of VA-CNTs shows lotus-leaf-like super-hydrophobic topography. The micro-patterns in CNT bundles create a micro-scale roughness while the individual nanotubes contribute to the nano-scale roughness. Due to the dual roughness like a lotus leaf, nanotubes have stopped water seeping into air pockets between the micro-pattern, leading to less water sticking. The high hydrophobicity of CNTs results in high oleophilic properties, leading to greater extent of oil removal. On the contrary, the CA of randomly entangled CNTs/silicon plates is very low due to the loss of micropattern roughness on the surface. These findings demonstrate that the CAs on various CNTs' top surfaces are significantly affected by the orientation of carbon nanotubes. Furthermore, CNTs with different surface morphologies can be synthesized by changing experimental parameters. This method followed a single step to synthesize the dual-scale surface roughness of VA-CNTs on Si plates. Thus, the study of different nanostructures supports the optimization of superhydrophobicity, leading to improved water repellence and oil absorption, expanding the range of applications from self-cleaning to anti-fouling and more. However, further research and development is needed to overcome the challenges and refine the technology for widespread use.

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