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Facile preparation of superhydrophobic thin films using non-aligned carbon nanotubes

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Abstract. A simple preparation method on creating superhydrophobic surface using non-aligned carbon nanotubes (CNTs) was demonstrated. Superhydrophobic CNT thin films were prepared by doping a sonicated mixture of CNTs and chloroform onto a glass slide. Water contact angles of the CNT thin films were measured using a contact angle goniometer. The thin films were characterized using laser microscope and scanning electron microscope. Experimental results revealed that the highest average contact angle of 162±2° was achieved when the films' thickness was 1.628 μm. The superhydrophobic surface was stable as the contact angle only receded from 162±2 to 157±2° after 10 min under normal atmospheric condition.

Keywords: carbon nanotubes; non-aligned, superhydrophobic; thin film; characterization

1. Introduction

The size, shape and extraordinary physical properties of CNTs, such as high strength, extraordinary flexibility and resilience, make them a subject of unabated scientific research and development in recent years (Iijima 1991, Salvetat *et al.* 1999). CNTs are one of the most common types of materials which have the potential in fabricating superhydrophobic surfaces. In nature, superhydrophobicity can be observed from many plant leaves, most commonly on lotus leaves. For example, water droplets which fall onto the top of the lotus leaf would roll or bounce off. At the same time, dust particles or surface contaminants which usually appear on the leaf can be removed simultaneously. This effect is caused by the hierarchical roughness of the leaf surface from micrometer-sized papillae having nanometer-sized branch like protrusions and the intrinsic material hydrophobicity of a surface layer of epicuticular wax covering these papillae (Ma *et al.* 2008, Shakerzadeh *et al.* 2009).

Self-cleaning is the most common application of superhydrophobic surfaces (Bhushan and Jung 2011, Lau and Gleason 2007, Song *et al.* 2009). This application can be seen in our daily lives such as window panels, roof tiles, bathroom surfaces and house walls. By implementing the

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