

Novel, stable and durable superhydrophobic film on glass prepared by RF magnetron sputtering

Objective

The objective of this work is to fabricate a nanostructured superhydrophobic (SHP) film on a glass substrate by radio frequency (RF) magnetron sputtering and to analyze its surface morphology, XRD pattern, chemical composition and wettability by corresponding methods.

Sample Preparation

First, an Al-Zn film was fabricated by RF magnetron sputtering. Next, an Al_2O_3 -ZnO hierarchical network film interwoven by nanofibers was obtained after annealing treatment in a muffle furnace. Finally, hexadecyltrimethoxy silane (HDTMS) was used to achieve superhydrophobicity of the film as the as-prepared SHP surface.

Data acquisition

X-ray diffraction (XRD; Panalytical Empyrean, Netherlands) was performed to characterize the crystal structure of the SHP film. The XRD patterns of the as-prepared SHP surface were obtained before and after the annealing process, in a range of the 2θ /degree between 30° and 90° . The results were compared with the following Standard X-ray Cards: before annealing treatment Al (JCPDS Card No. 04-0787) and Zn (JCPDS Card No. 04-0831), after annealing treatment Al_2O_3 (JCPDS Card No. 10-0173) and ZnO (JCPDS Card No. 03-0888).

Representative figures & Results

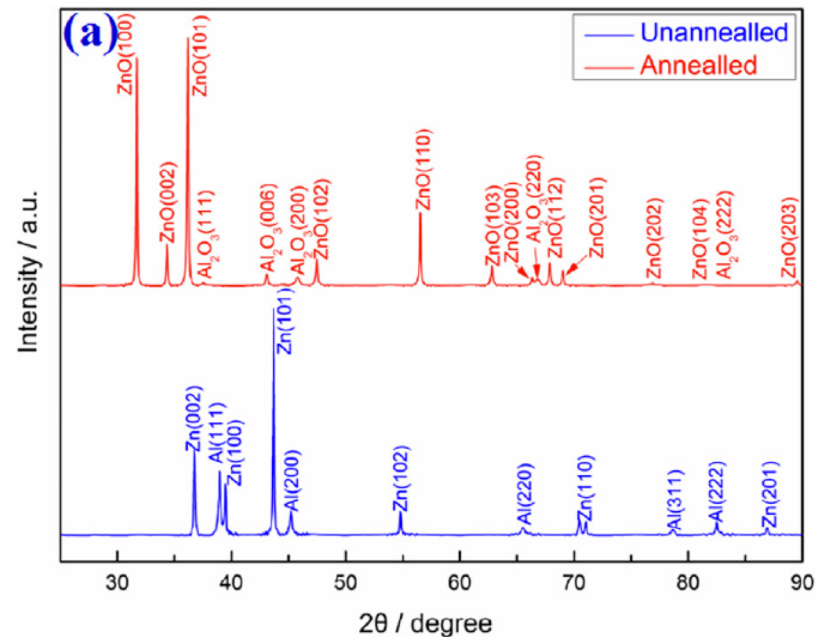


Fig. 2. The as-prepared SHP surface's (a) XRD patterns before and after annealing treatment

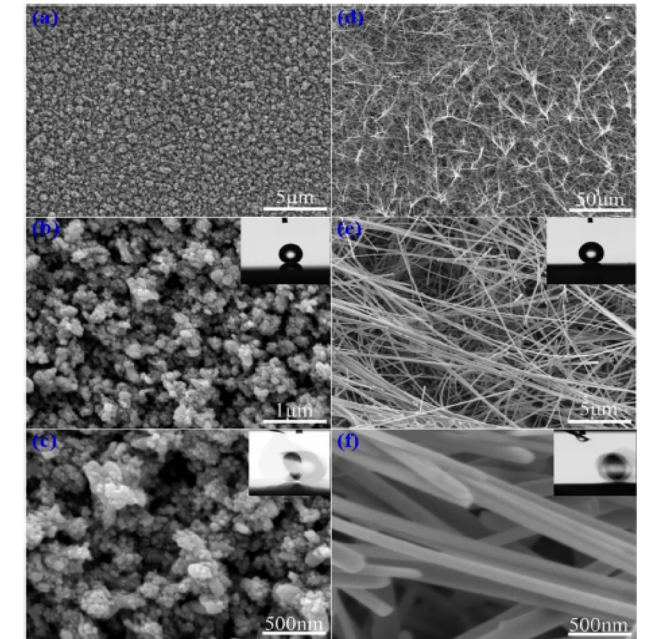


Fig. 1. SEM images of the Al-Zn SHP surface prepared by RF magnetron sputtering at (a) 5000 x, (b) 25,000 x, (c) 50,000 x (left), and the as-prepared SHP surface after annealing treatment (d) 500 x, (e) 5000 x, (f) 50,000 x (right).

Conclusion

The SHP Al_2O_3 -ZnO film with a hierarchical network on glass was efficiently fabricated by RF magnetron sputtering followed by annealing treatment. Also, it was found that the as-prepared SHP surface exhibited a prominent superhydrophobicity which was mainly attributed to the low surface energy of the HDTMS and the Al_2O_3 -ZnO nanofibers. Moreover, the SHP surface demonstrated good stability under outdoor and ambient environment, and retained its superhydrophobicity even at severe temperatures as well as in strong corrosive surroundings.