Nanocomposites and nanomaterials

Owens-Wends characterization of superhydrophobic shift

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INTRODUCTION

The shift of the thin layer coating with a hierarchical structure to a superhydrophobic Cassie state is usually monitored with the sessile drop technique of water contact angle determination. However, more accurate view on the surface energy characterization may be obtained by the use of two-component theories and respective set of the probe liquids.

MATERIALS AND METHODS

The aim of this study is the characterization of the surface energy change in conditions of superhydrophobic shift using Owens-Wendt theory. The subject of the study is two-component system based on hydrophobically surface treated nanoscale silica particles and styrene-acrylic film-forming polymer. The reference system was prepared by the shear mixing of 0,5 g of polymer dissolved in 43 ml of o-xylene with 9,5 g of silica. The slurry was used to form thin films on the glass surface with the gauge applicator. Probe liquids used for the consequent contact angle determination were glycerol, water, diiodomethane.

RESULTS AND DISCUSSION

Test systems were obtained by the variation of the polymer/silica ratio around the reference point. It was found that the transition from the hydrophobic to a superhydrophobic state is near the reference point and corresponds to 3 wt. % of silica content.

Despite the disperse component of the surface tension remains constant, the polar significantly changes from 10,7 to 5,5 mJ/m^2 with the increase of silica content from 3 to 60 wt. %, whereas the value of the water contact angle remains constant – near 132°.

CONCLUSIONS

The Owens Wendt approach may be used for the more precise characterization of superhydrophobic systems surface energy change. In particular, it is more sensitive to a contact surface fraction determination than ordinary contact angle measurements.