Simple, Cheap and High Yield Maskless Processing to Produce Robust Superhydrophobic Silicon without Hydrophobic Coatings

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We introduce a simple and cheap maskless process (without photolithography) to demonstrate robust superhydrophobic silicon surfaces without a hydrophobic (polymeric) coating. The surface is composed of collapsed silicon nanowires on microcones. Only 3 min Cryogenic inductively coupled plasma (ICP) silicon etching was used to produce highly regular array of microcones (Figure 1a). Subsequently 2 s silicon nanowires are produced using metal-assisted chemical etching (MaCE) using gold as catalyst in HF:H_2O_2 (1:1) solution (Figure 1b). Robust superhydrophobicity originates from micro/nano hierarchical structures [1]. Trapped air pockets below the hierarchical structures resist the water droplet and make the surface superhydrophobic. Water contact angle is 166° with 5° hysteresis after MaCE (insets in Figure 1). Superhydrophobic surfaces without hydrophobic coatings are tolerant to UV exposures or acidic treatments that cause decomposition of coatings from typical polymeric coated surfaces [1]. The demonstrated maskless approach offers ease in fabrication and is low cost with high yield compared to conventional superhydrophobic surfaces produced by photolithography and hydrophobic coatings [2].

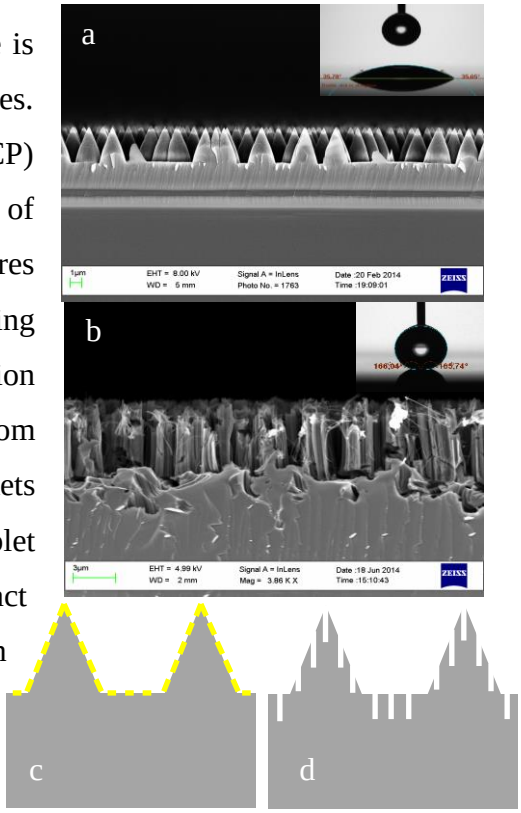

Fig.1 SEM micrograph of microcones coated with gold nano-islands (a) before and (b) after MaCE. Schematic of the structures with gold nano-islands (c) before and (d) after

References

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