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Underwater Stability of Surface Chemically Modified Superhydrophobic W18O49 Nanowire Arrays

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Superhydrophobic W18O49 nanowire (NW) arrays were synthesizedusing a thermal evaporation and surface chemistry modification methods by self-assembled monolayer (SAM). As-prepared non-wetting W18O49 NWs surface shows water contact angle of 163.2^{o} and has reliable stability in underwater conditions. Hence the superhydrophobic W18O49 NWs surface exhibits silvery surface by total reflection of water layer and air interlayer. The stability analysus of underwater superhydrophobicity of W18O49 NWs arrays was conducted by changing hydrostatic pressure and surface energy of W18O49 NWs arrays. The stability of superhydrophobicity in underwater conditions decreased exponentially as hydrostatic pressure applied to the substrates increased3. In addition, as surface energy decreased, the underwater stability of superhydrophobic surface increased sharply. Specifically, sueprhydrophobic stability increased exponentially as surface energy of W18O49 NWs arrays was decreased. Based on these results, the models for explaining tendencies of superhydrophobic stability underwater resulting from hydrostatic pressure and surface energy were designed. The combination of fugacity and Laplace pressure explained this exponential decay of stability according to hydrostatic pressure and surface energy. This study on fabrication and modeling of underwater stability of superhydrophobic W18O49 NW arrays will help in designing highly stable superhydrophobic surfaces and broadening fields of superhydrophobic applications even submerged underwater.

Keywords: Superhydrophobic, Wettability