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Underwater Stability of Surface Chemistry Modified Superhydrophobic WOx Nanowire Arrays

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Superhydrophobic WOx nanowire (NW) arrays were fabricated using a thermal evaporation and surface chemistry modification methods by self-assembled monolayer (SAM). As-prepared non-wetting WOx NWs surface shows water contact angle of 163.2° and has reliable stability in underwater conditions. Hence the superhydrophobic WOx NWs surface exhibits silvery surface by total reflection of water layer and air interlayer. The stability analysus of underwater superhydrophobicity of WOx NWs arrays was conducted by changing hydrostatic pressure and surface energy of WOx 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 WOx 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: Wettability, Superhydrophobicity

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Atomic Layer Deposition of Ruthenium Thin Film from Ru (cymene) (1,5-hexadiene) and O2

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Ruthenium (Ru) 박막은 우수한 화학적·열적 안정성 및 높은 일함수(4.7eV) 특성으로 인해 20 nm급 이하의 차세대 DRAM capacitor의 전극 물질 및 Cu metalization을 위한 seed layer로 각광을 받고 있다. Ru박막의 나노스케일 정보전자소자로의 적용을 위해서는 두께제어가 용이하고 3D 구조에서 우수한 단차 피복 특성을 갖는 atomic layer deposition (ALD)을 이용한 박막 형성이 필수적이다. 이에 본 연구에서는 ALD 방법을 이용하여 0가의(cymene) (1,5-hexadiene) Ru (0) (C16H24Ru) 전구체를 합성, ALD 방법을 이용하여 우수한 초기성장거동을 갖는 Ru 박막을 증착 하였다. 형성된 Ru 박막의 표면 형상, 두께, 밀도를 주사전자현미경(Scanning electron microscopy)과 X-선 반사율 측정(X-ray reflectometer)으로 조사하였다. 또한 전기적 특성을 4침법(four-point-probe)으로 측정하였고, 박막의 화학적 조성과 결정성의 정보를 X-선 광전자분광법(X-ray photoelectron spectroscopy)과 X-선 회절(X-ray diffraction)을 이용하여 확인하였다.

Keywords: ALD,Ru, Ru ALD, noble metal material, Ru precursor, metal electrode