Short Communication

Effect of H₂ Flow Rate on Corrosion Resistance of Tantalum Coating Prepared on Molybdenum via Chemical Vapor Deposition

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Tantalum coatings prepared via chemical vapor deposition (CVD) tantalum are a key material for service in extremely corrosive environments, and are especially important in the aerospace, weapon equipment, and nuclear industries. However, a strong preferred orientation, which affects the corrosion resistance of the coatings, typically develops during the deposition process of these coatings. In this work, the effects of hydrogen gas (H₂) flow rate on the preferred orientation of a tantalum coating were investigated via first-principles calculations and experiments. The effects on the surface energy and work function of different crystal planes and the corrosion resistance of the coatings were also investigated. The results revealed that the lowest texture coefficient and weakest preferred orientation occur for the coating prepared at 400 mL/min. Similarly, the (110) crystal plane of tantalum had lower surface energy (0.145 eV) and higher work function (4.742 eV), and exhibited better corrosion resistance than the other planes. More importantly, the corrosion potential and the corrosion current density of the coating prepared with 400 mL/min H₂ flow were -0.424 V and 0.535 $\mu\text{A}\cdot\text{cm}^{-2}$, respectively, and this coating exhibited the highest corrosion resistance. The present work can serve as a reference for improving the corrosion resistance of tantalum coatings.

Keywords: tantalum coating; corrosion resistance; H₂ flow rate

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