Development of FeNiMoWCuN and FeNiMoWCuC high entropy alloy thin film as efficient electrocatalysts for water-splitting applications

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This study investigates the microstructure and electrocatalytic properties of FeNiMoWCuN and FeNiMoWCuC high entropy alloy (HEA) thin films deposited by high power impulse magnetron sputtering (HiPIMS) and direct current (DC) magnetron sputtering techniques, respectively. The HEA films were fabricated at various argon-to-nitrogen and argon-to-acetylene gas flow ratios to assess the impact of nitrogen and carbon contents, respectively, on the phase, microstructure, and electrocatalytic properties of the thin films. A proper nitrogen content was found to promote the formation of the metal nitride phase, thereby enhancing the electrocatalytic activity of the films. Notably, improved performance was observed for the HEA films with different N contents in the hydrogen evolution reaction (HER) and oxygen evolution reaction (OER), characterized by lower overpotentials and smaller Tafel slopes. Similarly, a proper carbon content was achieved for FeNiMoWCuC, resulting in improved electrocatalytic performance. Overall, FeNiMoWCuN and FeNiMoWCuC thin films deposited using HiPIMS and DC with optimized nitrogen content exhibited superior electrocatalytic properties, highlighting their potential for applications in water splitting.

Keywords: FeNiMoWCuN, FeNiMoWCuC high entropy alloy thin film, high power impulse magnetron sputtering, electrocatalytic