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Determination of Superlattice Effect on Hafnium nitride/Vanadium nitride Nano-structures

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Binary nitrides multilayers systems were grown on silicon (100) substrates with the aim to study the coherent assembly in HfN/VN material. The multilayers films were grown via reactive r.f. magnetron sputtering technique by systematically varying the bilayer period (Λ) and the bilayer number (n) while maintaining constant the total coating thickness ($\sim 2.4 \mu\text{m}$). The multilayers were characterized by High angle X-ray diffraction (HA-XRD), low angle X-ray diffraction (LA-XRD), HfN and VN layers were analyzed by X-ray Photoelectron Spectroscopy (XPS) and electron and transmission microscopy (TEM). HA-XRD results showed preferential growth in the face-centered cubic (111) crystal structure for HfN/VN multilayers system with the epitaxial relation $(111)[100]_{\text{HfN}} // (200)[100]_{\text{VN}}$. The maximum coherent assembly was observed with presence of satellite peaks. With this idea, ternary and binary nitrides films have been designed and deposited on Si (100) substrates with bilayer periods (Λ) in a broad range, from nanometers to hundreds of nanometers to study the structural evolution, coherent assembly progress and optical properties like The critical angle, dispersion coefficient, index of refraction for HfN/VN multilayers with decreasing bilayer thickness.

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