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Wide variation in the structure and physical properties of reactively sputtered (TiZrHf)N coatings under different working pressures

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Abstract

The dependence of the structure of (TiZrHf)N coatings deposited by reactive magnetron sputtering on different working pressures and their mechanical and electro-optical properties were investigated. The increased working pressure contributed to the decreased oxygen contamination. With increased working pressure, the compressive stress was transitioned to tensile one. Compressively stressed coatings consisted of tightly packed columns with a smooth surface. The tensile stressed coatings presented void network structure surrounding the columnar grains with a rough surface. Moreover, the grain size initially increased and subsequently decreased. Accordingly, the (TiZrHf)N coatings deposited at high working pressure were characterized with poor hardness, low electrical conductivity, and low light reflectivity due to the porous structure resulting from high oxygen contamination. In addition, the coating color changed from bright gold to dark gray. In this study, the working pressure was proven a sensitive deposition parameter in controlling the microstructure, mechanical, and electro-optical properties of the coating. The wide structural variation in the (TiZrHf)N coatings allowed a diverse physical performance suitable for a broad range of applications.