X-Ray Analyses of Residual Stresses in TiB2 Layers Electrodeposited from Molten Salts using Pulse Plating Techniques

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Abstract

Titanium diboride is a promising refractory compound for a variety of technological applications. It exhibits high corrosion and wear resistance even at high temperatures. Electrodeposition of TiB2 layers is an alternative to other deposition methods like PVD and CVD, offering the advantage of high deposition rates and uniform coverage even in samples with complicated geometries. Titanium diboride coatings were deposited on Mo substrates from a NaCl-KCl-NaF-K2TiF6-KBF4 and LiF-Kf-NaF-K2TiF6-KBF4 melts at 700C and 600C respectively. The stresses of the layers obtained with both electrolytes were investigated and compared. Stresses were correlated with the electrochemical deposition parameters, namely deposition mode (Direct Current vs. Pulse Plating), deposition time, mean current density, peak current density and frequency of the current pulses. The residual stresses of the layers obtained were studied by X-ray diffraction employing the sin2(psi) method. It was found that the coatings show compressive residual stresses in the range of 0.8 to 2.5 GPa, depending on deposition conditions. The contributions of thermal mismatch stresses and intrinsic film stresses induced during film growth are discussed. The residual stresses obtained with this method were compared with literature results from other methods, including PVD and CVD.