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Microstructure, mechanical and electrical properties evaluation of TiZrN and ZrTiN coatings fabricated by a hybrid HIPIMS and RF sputtering system

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The high power impulse magnetron sputtering (HIPIMS) has been widely studied due to its ultra-high peak current and peak power density to achieve unique thin film microstructure and mechanical properties. In this study, a hybrid coating system consisting of a high power impulse magnetron sputtering (HIPIMS) and a radio frequency (RF) sputtering was used to deposit eight TiZrN and ZrTiN coatings. The phase of the coatings was analysis by X-ray diffractometer (XRD). The microstructures of thin films were examined by the field-emission scanning electron microscopy (FE-SEM). Atomic force microscopy (AFM) was used to characterize the surface morphology. The nanoindentation was used to evaluate the hardness properties of thin films. The scratch tests, Daimler- Benz Rockwell-C (HRC-DB) adhesion tests and pin-on-disk wear tests were used to evaluate the adhesion and tribological properties of thin films, respectively. Electrical conductivities of eight coatings were measured using a four-point probe. Effects of Ti and Zr concentrations, duty cycle and pulse frequency of HIPIMS system on the microstructure, electrical and mechanical properties of TiZrN and ZrTin thin films were discussed in this work.

Keywords
High power impulse magnetron sputtering
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