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New cylindric high power impulse magnetron sputtering system: discharge and CrN coating deposition

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Abstract: To avoid the disadvantages of High power impulse magnetron sputtering (HiPIMS), such as low deposition rate, arcing, ionization difference of different sputtering materials, and so on [1-3], a newly developed cylindric high power impulse magnetron sputtering system in this paper. And CrN coatings depended on the N_2 partial pressures and extraction magnetic field currents are fabricated by reactive HiPIMS.

The discharge and plasma were investigated by Langmuir probe and ion energy analyzer. CrN coatings depended on the N_2 partial pressures and extraction magnetic field currents were fabricated by reactive HiPIMS. The morphology and microstructure of CrN coatings were studied by scanning electron microscopy (SEM), X-ray diffraction (XRD), X-ray photoelectron spectroscopy (XPS) and transmission electron microscopy (TEM). And the mechanical properties of the CrN coatings were measured by nanoindentation, scratch test instrument and a ball-on disk tester. The electro-chemical corrosion test was performed on a reference 600 electrochemical analyzer.

The results show that the plasma density and ionization are greatly improved in the new discharge system by hollow cathodic effect and the deposition rate increases with increase the extraction magnetic field currents, exhibiting 2-3 times that of planar sputtering source. The prepared CrN coatings show a dense structure and a smooth surface which enhance the friction and corrosion resistance significantly.

The discharge characteristic of the newly developed cylindric high power impulse magnetron sputtering system has been collected. And the high performance CrN coatings have been fabricated by the system.

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