As a pivotal moving part of the momentum wheel applying to control the position accuracy and working life of three-axis stabilized satellite, B7004 bearing is used to support the main rotating shaft and usually works at quite higher speed from 3000 to 6000 rpm. The tribological performance of surface layer directly affects the service life of the bearing. Plasma Immersion Ion Implantation (PIII) technology can prepare uniform wear resistance layer on complex shape surface, so it is a promising method to improve the service life of the B7004 bearing.

Single and dual ion implantation types with different ion formulas are carried on the 9Cr18Mo steel samples which mainly used as the material to fabricate B7004 bearing. The performance of vacuum tribology of the samples are evaluated by XPS, nano-indentation, ball-on-disc and surface profile tester. At the same time, impact parameter of implantation are simulated by TRIM program. It has been found that: (1) The modified effect of single N implantation is very significant, and the simulation results are consistent with test. (2) After 9Cr18Mo samples implanted with 5 different ion formulas, the hardness and wear resistance have been enhanced, while the effect of dual implantation is better than single implantation. (3) Compare with other ion formulas, Ti+N dual implanted sample show the highest hardness 13.97GPa, elastic modulus 375GPa, and the substrate trace is narrow and shallow. Meanwhile, with a smooth friction curve, small surface roughness and best wear resistance under grease lubrication condition, the friction coefficient has a minimum at 0.07. The main reason is that the implanted layer forms hard and wear-resistant phases, so the metallicity is weaken and the friction and wear mechanism is changed from devastating adhesive wear into mild abrasive wear.

Keywords
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