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Mechanical, wear, corrosion and biological properties of arc deposited Titanium nitride coatings

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Abstract

Cathodic arc deposition of ceramic coatings is graining importance due to their good adhesion and minimum residual stresses. In this work we have arc deposited TiN coatings on Ti6Al4V alloy and evaluated their mechanical, corrosion, *in vitro* tribological and biological properties for implant applications. Coatings exhibited high hardness of 33.4±10 GPa and Young's modulus of 458.4±79 GPa. Scratch tests revealed that the coatings fail adhesively at 2.9 ± 0.3 GPa. Hydrophilic nature of the coatings enabled protein adsorption leading to surface passivation and significant increase in the *in vitro* corrosion resistance. The inherent *in vitro* wear rate of the coatings was $6.8\pm1.7\times10^{-7}$ $mm^3/N.m$ against Al_2O_3 ball. The wear rate of ultrahigh molecular weight polyethylene tested against TiN coatings was $1.9\pm0.7\times10^{-5}$ $mm^3/N.m$, which appears to be better than against CoCrMo alloy. *In vitro* biocompatibility studies performed using mouse embryonic fibroblast cell line (NIH3T3) demonstrated that the coatings are non-toxic and exhibit excellent cell-materials interactions. Further improvement in the performance of present cathodic