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WEAR RESISTANCE OF SILICON NITRIDE COATINGS IN A HARD-ON-SOFT CONTACT

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Summary: Ultra high molecular weight polyethylene (UHMWPE) and CoCrMo alloy are widely used as bearing couple in hip implants. However, the release of metal ions and wear particles from the materials may lead to inflammation and in the worst case implant revision. Silicon nitride based (SiNx) coatings have been proposed as a means to reduce metal ion release. This study aimed to investigate the ion release and wear resistance of SiNx coatings deposited onto CoCrMo full head implants, when worn against UHMWPE. A HIPIMS process was used to sputter a CrN interlayer followed by a SiNx top layer using 3-fold rotation in an industrial deposition system (CemeCon AG, Würselen, Germany). An AMTI Ortho POD wear tester was adapted to run 32 and 36mm hip heads against flat polymer discs made of UHMWPE. Tests were run in a 25 vol.% fetal bovine serum solution at 37±3ºC. Vertical Scanning Interferometry, Stylus profilometry and Scanning Electron Microscopy were used to characterize wear tracks and worn surfaces. Cross-sections of coated implants were obtained by Focused Ion Beam to visualize the present layers. Metal ion release was measured by ICP-OES. The SiNx coatings showed low wear and reduced metal ion release, hence demonstrating a potential for improving the biological response in future studies.