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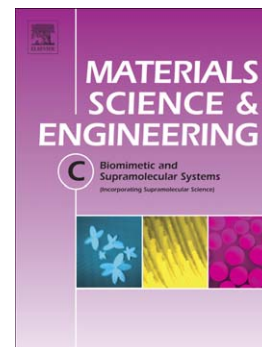
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Dissolution behaviour of silicon nitride coatings for joint replacements

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In this study, the dissolution rate of SiN_x coatings was investigated as a function of coating composition, in comparison to a cobalt chromium molybdenum alloy (CoCrMo) reference. SiN_x coatings with N/Si ratios of 0.3, 0.8 and 1.1 were investigated. Electrochemical measurements were complemented with solution (inductively coupled plasma techniques) and surface analysis (vertical scanning interferometry and x-ray photoelectron spectroscopy). The dissolution rate of the SiN_x coatings was evaluated to 0.2-1.4 nm/day, with a trend of lower dissolution rate with higher N/Si atomic ratio in the coating. The dissolution rates of the coatings were similar to or lower than that of CoCrMo (0.7-1.2 nm/day). The highest nitrogen containing coating showed mainly Si-N bonds in the bulk as well as at the surface and in the dissolution area. The lower nitrogen containing coatings showed Si-N and/or Si-Si bonds in the bulk and an increased formation of Si-O bonds at the surface as well as in the dissolution area. The SiN_x coatings reduced the metal ion release from the substrate. The possibility to tune the dissolution rate and the ability to prevent release of metal ions encourage further studies on SiN_x coatings for joint replacements.

Keywords: silicon nitride; cobalt chromium; coating; dissolution; corrosion; mass loss; joint replacement

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