

MXENE-REINFORCED CoCrMo COMPOSITES FOR BIOTRIBOLOGICAL APPLICATIONS FABRICATED BY ADDITIVE MANUFACTURING

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Biotribology; Friction; Wear; Composite materials

ABSTRACT

The development of advanced materials for biomedical applications is crucial to enhance the performance and longevity of medical implants [1, 2]. Therefore, this study presents the development and characterization of MXene-reinforced CoCrMo composites designed for biotribological applications and fabricated by additive manufacturing (AM). The composites were prepared by incorporating 1 wt.%, 2 wt.%, and 3 wt.% of $Ti_3C_2T_x$ -MXenes into medical-grade Co28Cr6Mo powder. A precise composite preparation process was employed, and pin samples were fabricated using a laser powder bed fusion AM technique. Post-fabrication, samples underwent cutting, mirror polishing, and ultrasonic cleaning to meet specifications for metallic load-bearing implants. Comprehensive characterization of the samples involved scanning electron microscopy, transmission electron microscopy, and Raman spectroscopy. The surface roughness and micro-indentation hardness of the composites were assessed using white light interferometry and micro-indentation, respectively. Biotribological testing was conducted using a stress-controlled modular compact rheometer with a tribo-cell featuring a ball-on-three-pin configuration under dry and substitute body fluid (SBF) lubricated conditions at 37°C. The study reports an enhancement into the mechanical and biotribological properties of the MXene-reinforced CoCrMo composites (**Fig.1**), demonstrating their potential for wear resistance biomedical implants.

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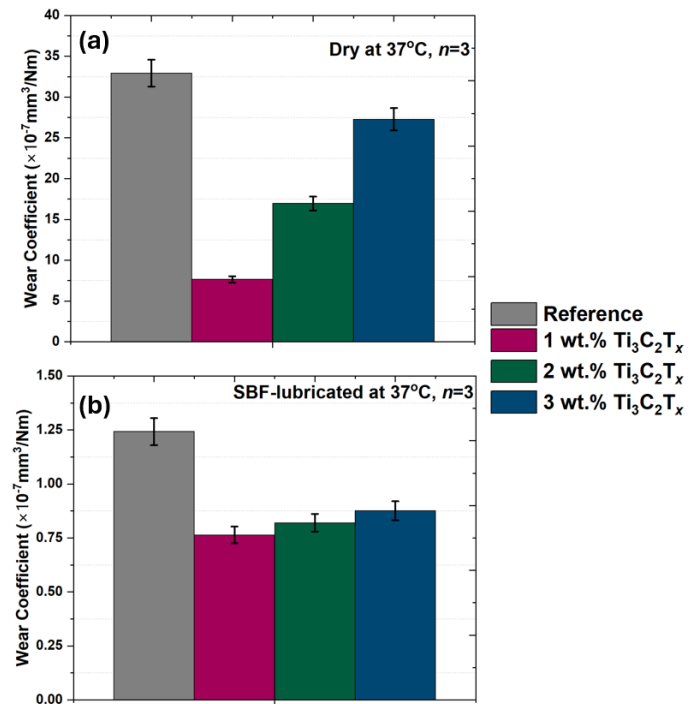


Fig.1 Wear coefficients of the reference and CoCrMo composites with different concentrations of MXenes tested under (a) dry and (b) SBF-lubricated conditions.

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