Influence of graphene reinforcement on the tribological properties of titanium alloy prepared by laser-based powder bed fusion

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The advancement of additive manufacturing technology increasingly allows for more complex design. Titanium alloys are a popular class of materials that are extensively fabricated using additive manufacturing technology due to their excellent mechanical properties and corrosion resistance. Yet, their well-recorded poor wear resistance limits their applications. To improve the tribological properties of titanium alloys, reinforcement materials can be used. In this study, we utilized Powder Bed Fusion Laser Beam (PBF-LB) to produce Ti6Al4V alloy reinforced by graphene, a material known for its lubricative properties. We investigate and discuss in detail the morphology of the resulting material, with a special focus on the distribution of the reinforcement graphene. The effect of graphene flake composition in the starting powder on the tribological performance of the printed material is studied unlubricated in a reciprocating sliding test. The friction coefficient is monitored throughout the test and the resulting wear scars are examined after the test to reveal any influence on the wear mechanism. This study contributes to the field of tribologically enhancing materials using additive manufacturing including graphene and specifically, serves to pave the way for more general applicability of titanium alloys in tribological components.

Keywords: Powder bed fusion, titanium matrix composite, graphene, tribology.

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