**Enhanced Mechanical Properties in Cold Spray-Produced Titanium/Hydroxyapatite Biocomposites**

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The demand for artificial bones derived from biocomposites has rapidly increased in recent years. The global orthopedic implants market is expected to reach USD 73.5 billion by 2026. Inspired by hydroxyapatite (HAP) as one of the key natural bone ingredients, the present work explores titanium (Ti)-hydroxyapatite (HAP) biocomposites design with enhanced mechanical properties. HAP often hinders the cold spray of Ti-HAP biocomposites. It leads to agglomerations, unavoidable and random porosities, and poor coating quality. Here we explore the roles of Ti and niobium (Nb) bond coats to control the coating quality of Ti-HAP and simultaneously improve the nano- to bulk-scale mechanical properties.

Atomic force microscopy (AFM) showed that Young’s modulus of Ti-HAP (130.3 GPa) was significantly higher than that of pure Ti (78.8 GPa). However, the Vicker’s hardness (HV30) of both composites was similar to ~130 HV30. Interestingly, the Ti and Nb bond coats helped increase the flexural strengths from 219 (Ti-HAP) to ~310 MPa (Ti-HAP on Ti or Nb bond coat). This enhanced bulk-scale flexural strength was attributed to the reduced porosities and improved structural homogeneity of the composites. The biocompatibility tests of these biocomposites are in progress. The findings of the work will have a direct impact on the rapid and scalable fabrication of bone implants for biomedical applications.