

On Cold Kinetic Spraying of Hydroxyapatite and TiO₂ Bioceramics onto Ti-6Al-4V and Glass Substrates

J. Cizek, K.A. Khor

Nanyang Technological University, School of Mechanical and Aerospace Engineering,
50 Nanyang Avenue, 639798, Singapore

Abstract. Cold spray kinetic spraying is an emerging technology likely to replace the well-established plasma spraying. Having a low-temperature character, some issues decreasing the quality of common plasma deposits are not encountered in cold spraying. However, other problems are yet to be resolved, namely the coating build-up of hard and brittle ceramic materials intended for deposition.

This research aimed at cold spraying of two ceramic compounds used in biomedical applications: hydroxyapatite (HA), a traditional calcium-phosphate used for e.g. coating of hard-tissue replacements and a novel titanium oxide (TiO₂) proven to exhibit bioactive properties.

In-house produced HA and commercially available TiO₂ powders were deposited onto Ti-6Al-4V alloy and glass substrates. The microstructure and morphology of the deposits were investigated using SEM and the relative changes in the phase and element compositions of the coatings as compared to the initial powder feedstock were measured using Rietveld XRD and EDX methods. It was found that the cold sprayed coatings retained their phase and element compositions (as compared to their plasma sprayed counterparts) and the porosity of the produced coatings is almost non-existent.

To address the problem of a coating build-up, blends of the powders with Al powder were prepared in different wt% ratios. The blended powder mixtures were cold sprayed and the resulting coatings were investigated. It was found that at least 60wt% of the Al powder is needed for a successful stacking of adjacent layers of the coating.