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Depth-resolved studies of plasma sprayed hydroxyapatite coatings by means of diffraction techniques

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Hydroxyapatite coating (HAp, $\text{Ca}_{10}(\text{PO}_4)_6\text{OH}_2$), produced by air plasma spraying, was investigated for depth profiling behavior of phase composition, crystallinity and residual stress using diffractometry techniques. Probing was carried out using conventional 8 keV laboratory X-rays, 11 keV and 100 keV radiations from 2nd and 3rd synchrotron facilities, respectively. The latter employed measurements in transmission geometry. Results showed HAp together with its thermal products tetracalcium phosphate (TTCP), tricalcium phosphate (TCP) and calcium oxide to be present throughout the coating thickness. Quantitative refinement results employing Rietveld refinement showed HAp and TTCP to be the two main phases, with the former decreasing with depth whilst the latter increases. The largest changes occurred in the former showed a significant decrease in the first 45 μm . Crystallinity investigation indicated the coating to be more crystalline at the near-surface region decreasing with depth below the surface. Both the normal stresses σ_{11} and σ_{33} show a change in stress state i.e. from compressive in first 135 μm to tensile towards the coating-substrate interface.

Level (Hons, MSc,
 PhD, other)?

MSc

Consider for a student
 award (Yes / No)?

No

Would you like to
 submit a short paper
 for the Conference
 Proceedings (Yes / No)?

No

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