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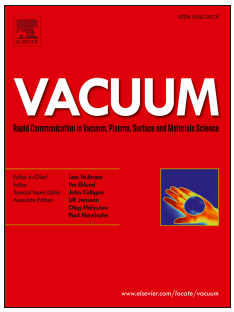

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Synthesis, structure and mechanical properties of Ti-Al-Nb coatings formed by electron beam additive technique

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Abstract

We present a detailed investigation of the synthesis and mechanical properties of Ti-Al-Nb coatings, formed by alloying of Ti substrates with Al and Nb films by selective electron-beam melting (SEBM) via continuous electron beam. A cycling mixing of pre-deposited bilayer Al/Nb films with a Ti substrate is realized, where the maximum number of the cycles is 3. The first one is a SEBM of a bilayer Al/Nb coating deposited on pure Ti substrate. The obtained after the first cycle specimen is further coated with the same bilayer coating and then subjected to a second SEBM cycle; the same procedure is repeated for the third cycle. The alloyed layers are characterized using Scanning Electron Microscopy (SEM), Energy Dispersive X-ray Spectroscopy (EDX), and X-ray Diffraction (XRD). The microhardness is also studied. The thickness of the coatings obtained after each cycle is about 20 μm. The specimen obtained after the first cycle exhibits an alloyed zone consisting of pure Ti with a small content of Al and Nb, while those manufactured by the following cycles represent Ti_2AlNb based phases. The microhardness increases from 180 HV0.03 for the pure Ti substrate to 570 HV0.03 after the third cycle.