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Microstructural properties of Ti2AlN coatings synthesized by multilayer deposition and subsequent annealing

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Ti_2AlN is a prominent ternary nitride and belongs to the class of nanolaminated $M_{n+1}AX_n$ phase materials which combine metallic and ceramic material properties. Due to the anisotropy in the lattice of $M_{n+1}AX_n$ phase materials, properties like conductivity, diffusion, fracture toughness, etc. are also anisotropic and are strongly influenced by the coatings texture. This, for possible application, a precise control of coating's microstructure and texture is mandatory. In this work we report on the successful synthesis of polycrystalline Ti_2AlN thin films with a preferential (000l) orientation on Al_2O_3 and ferritic steel substrates [1]. Fabrication of the coatings included the deposition of multiple Ti-AlN double layers and a subsequent annealing step. Investigations with scanning electron microscopy (SEM), X-ray diffraction (XRD), electron back scatter diffraction (EBSD) and Raman spectroscopy reveal a successful transformation of the multilayer system into a polycrystalline and dense Ti_2AlN coating. EBSD measurements on these macroscopic grains point to a preferred orientation in the [000l] direction. In further experiments, the Ti-AlN double layer thicknesses were varied between 11 nm and 34 nm. The pole figure analysis of these samples reveal an increase in the full width half maximum (FWHM) of the (0006) peak with decreasing double layer thickness. Experimental results of the influence of the microstructure on the fracture tolerance of the coatings shall also be presented.
[1] L. Gröner, L. Kirste, S. Oeser, A. Fromm, M. Wirth, F. Meyer, F. Burmeister, and C. Eberl, Surface and Coatings Technology, in press (2017)

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