Hydrogen barrier coatings based on oxidized Ti_2AlN MAX-phases

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Utilizing hydrogen as medium in energy conversion technologies often requires new construction materials or at least a profound surface conditioning of hitherto used materials to prevent hydrogen induced degradation. Aluminum containing $M_{n+1}AX_n$ phase materials have attracted increasing attention due to their good corrosion resistance, a pronounced self-healing effect and promising diffusion barrier properties for hydrogen. In this regard, Ti_2AlN MAX phase coatings were synthesized on ferritic steel substrates by physical vapor deposition. Raman spectroscopy revealed a formation of stable α-Al_2O_3 after an oxidation at 700°C. The permeation of deuterium from the gas phase was measured by mass spectrometry at temperatures of 30-300 °C and permeation reduction factors (PRF) were calculated. We measured a PRF of up to ~3700 for the oxidized sample. By designing Ti_2AlN coatings with adjusted oxide scale thicknesses effective permeation barriers can be achieved.