In-situ TEM investigation of microstructural evolution in magnetron sputtered Al-Zr and Al-Zr-Si coatings during heat treatment

The magnetron sputtered Al–Zr and Al–Zr–Si coatings were heat treated in-situ in a transmission electron microscope as well as ex-situ to observe their annealing behaviour and phase transformations. The samples were heated up to a temperature of 550 °C and then cooled to room temperature. A layered structure with alternating layers of Al and Zr/Si rich Al was found for the as deposited sputter coatings. During in-situ heat treatment, the phases formed in the coatings were analysed using selective area electron diffraction and energy dispersive Xrayspectroscopy. For the Al–Zr sputtered coatings, metastable L12–Al3Zr nucleated initially by splitting of Zr rich Al layers followed by transformation to equilibrium DO23–Al3Zr. Addition of Si to the Al–Zr sputtered coating resulted in the formation of DO22–Al2.6Si0.4Zr phase instead of the DO23–Al3Zr phase. The lattice parameters and compositions of different phases formed are measured and presented.

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