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Optimized design of cathodic arc evaporated nitride multilayer coatings regarding their high-temperature oxidation resistance and mechanical behaviour

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Nitride multilayer coatings have been widely studied to protect steel substrates in structural components of steam power generation plants. According to the literature[1], recent works of the authors showed that the oxidation behaviour of CrN coatings in a 100% steam atmosphere at 650ºC is excellent compared to TiN. However, the larger hardness and Young modulus of the latter, and the multilayer effect in both, the mechanical and the oxidation response, is a relevant issue under investigation. The design of the experimental setup to obtain meaningful information of the mechanical behaviour of the multilayer coatings poses a crucial challenge, due to the wide range of involved parameters in the overall response. The use of nanoindentation tests seems to be the most appropriate technique to this aim, although the ratio between the individual film thickness and the indentation depth becomes crucial to understand and devise optimal coatings for applications involving mechanical stresses. The present study combines a deep investigation of the oxidation response of these systems in the simulated working conditions of steam power generation plants, and the mechanical analysis of these multilayers in order to propose the optimal coating architecture for this industrial application.
[1] P.Panjan, B.Navinšek, A.Cvelbar, A.Zalar, J.Vlcek, Surf. Coat. Technol., 98, 1-3 (1998) 1497-1502.

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