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YTTRIUM OXIDE (Y_2O_3) – A CANDIDATE MATERIAL FOR ENVIRONMENTAL AND THERMAL BARRIER COATINGS

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Environmental barrier coatings (EBC) are considered to pave the way for the application of ceramic matrix composites (CMC) in turbine engines. Low thermal mismatch, good adherence, microstructural stability and resistance against high-temperature corrosion are key issues. Due to its high chemical stability and low thermal mismatch, Y_2O_3 is considered an attractive EBC material in particular for Al_2O_3/Al_2O_3 CMC. A variety of laboratory-scale specimen as well as prototypic engine components were coated with Y_2O_3 by means of air plasma spraying (APS). At high temperature Y_2O_3 and Al_2O_3 exhibit formation of a thin interdiffusion and reaction zone consisting of Y-aluminates providing a good coating adherence. As a result, APS Y_2O_3 -coated Al_2O_3/Al_2O_3 CMC exhibit a high durability versus thermal cycling. APS Y_2O_3 -coatings exhibit a high resistance against recession by inorganic particles commonly referred to as CMAS corrosion. Infiltration of molten CMAS is inhibited by a dense reaction layer as well as the specific coating microstructure. Columnar Y_2O_3 coatings manufactured by chemical and physical vapor deposition (MO-CVD, EB-PVD) exhibit inferior resistance to CMAS infiltration but outperform yttria stabilized zirconia (YSZ) coatings. Therefore Y_2O_3 may also be suitable as a CMAS-resistant overlay for standard YSZ TBC.