DELAMINATION OF CERAMIC TOP COAT ACCELERATED BY CMAS IN AN EB-PVD THERMAL BARRIER COATING SPECIMEN

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Application of thermal barrier coatings (TBCs) which provides thermal insulation to the underlying Nickel-based superalloy substrate has been key technologies in advanced gas turbines. More recently, it has been recognized that the TBCs can be damaged by calcium–magnesium–alumino-silicates (CMAS) resulting from siliceous minerals (dust, sand, ash) containing the intake air and from unclean fuels such as a syngas and biomass gas. In this work basic mechanisms and mechanics as well as the kinetics, were explored, via a model CMAS, by specifying a TBC specimen which consisted of a Ni-base superalloy, MCrAlY bond coat and YSZ top coat fabricated by electron beam physical vapor deposition (EB-PVD) process. It was demonstrated that the penetration and the resultant phase transformation of the YSZ with the CMAS were basic mechanisms(Fig.1(a)). It was a particular finding that the thickness of thermal grown oxide was significantly accelerated by CMAS at the top/bond coat interface, resulting in a predominant delamination of top coat(Fig.1(b)). The behavior was discussed, in comparison with that in the TBC specimen fabricated by an air plasma spraying process(Fig.1(c)).

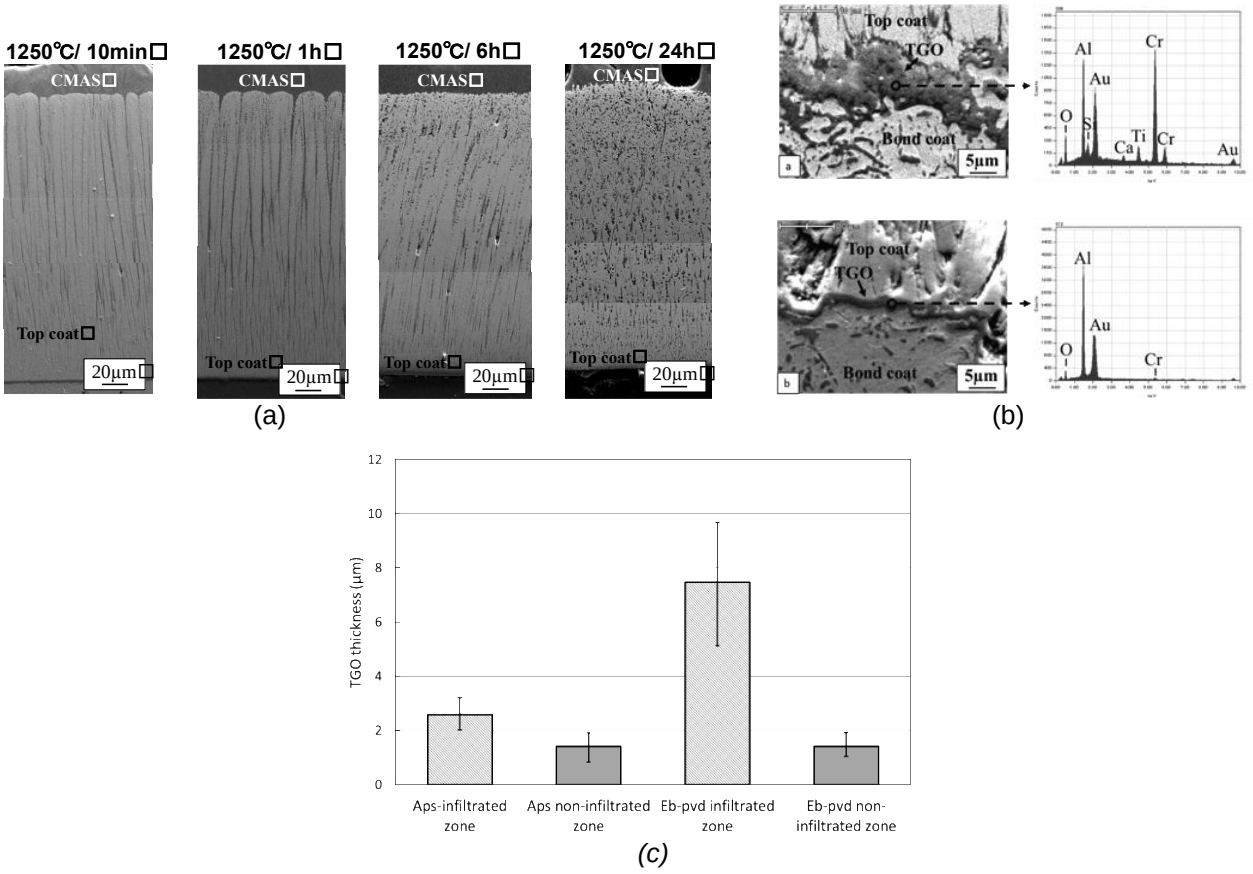

Fig. 1. CMAS damage evolution by CMAS in the EB-PVD specimen..

(a) CMAS Damage (b)TGO growth accelerated by the CMAS (c) Comparison of TGO thickness between EB-PVDed and APSed specimen.