DEVELOPMENT OF YTTRIUM AND YTTERBIUM SILICATES FROM THEIR OXIDES AND AN OLIGOSILAZANE PRECURSOR FOR COATING APPLICATIONS TO PROTECT Si_3N_4 CERAMICS IN HOT GAS ENVIRONMENTS

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Environmental barrier coatings are required to protect Si_3N_4 against hot gas corrosion and enable its application in gas turbines. In comparison to other environmental barrier coatings, rare-earth silicate-based coatings stand out due to the very low corrosion rates in moist environments at high temperatures and the compatibility of thermal expansion coefficient to Si_3N_4 ceramics. Thus, the polymer-derived ceramic route was used to synthesize yttrium and ytterbium silicates in the temperature range of 1000-1500 °C for basic investigations regarding their intrinsic properties from a mixture of Y_2O_3 or Yb_2O_3 powders and the oligosilazane Durazane 1800. After pyrolysis above 1200 °C in air, the corresponding silicates are already the predominant phases. The corrosion behaviour of the resulting composites was assessed after exposure to flowing moist air at 1400 °C for 80 h. The material containing Yb_2SiO_5 and $Yb_2Si_2O_7$ as main crystalline phases undergoes the lowest corrosion rate (-1.8 µg cm^{-2} h^{-1}). In contrast, the corrosion rate of yttrium-based composites remained at least ten times higher. Lastly, the processing of Y_2O_3/Durazane 1800 as well-adherent, crack-free and thick (40 µm) coatings on Si_3N_4 was achieved after pyrolysis at 1400 °C in air. The resulting coating consisted of an Y_2O_3/Y_2SiO_5 top-layer and an $Y_2Si_2O_7$ interlayer due to diffusion of silicon from the substrate and its interaction with the coating system.