MULLITE+CAS BOND COAT FOR ENVIRONMENTAL BARRIER COATINGS FOR Si-BASED CERAMICS

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The first generation EBC consists of mullite bond coat and yttria stabilized zirconia (YSZ) top coat. The disadvantages of the first generation EBCs are the tendency of plasma-sprayed mullite to form through-thickness cracks and the inability of YSZ to seal the cracks in mullite. A modified mullite bond coat, with much improved crack resistance and durability, was developed in the NASA HSR-EPM Program in late 1990s (1). The key to the modification was the addition of low CTE glass ceramics, such celsian (BSAS: xBaO.1-xSrO.Al_2O_3.2SiO_2) or anorthite (CAS: CAS: CaO.Al_2O_3.2SiO_2).

EBCs based on mullite+CAS bond coat and BSAS top coat were characterized using thermal cycling and thermogravemitry (TGA) in steam environments. Figure 1 compares the cross-section of mullite+CAS/BSAS-coated standard and MI SiC/SiC after 200h at 1225^{o}C in steam. Standard SiC/SiC formed significantly thicker scale than MI. MI developed a thinner scale on the surface having silicon layer, indicating benefits of MI in improving the durability of EBC. The improved oxidation resistance on a silicon surface layer is attributed to improved EBC adherence, presumably due to enhanced EBC-substrate chemical bonding.

Figure 2 compares the specific weight gain of mullite+CAS/BSAS-coated SiC/SiC in high steam at 1225^{o}C. Standard and enhanced SiC/SiC showed higher weight gain than MI after a 100h exposure. The superior performance of EBC on MI compared to standard or enhanced SiC/SiC is consistent with the thermal cycling tests.

1. K. N. Lee, *Surface and Coatings Technology*, "Current Status of Environmental Barrier Coatings for Si-Based Ceramics," **133-134** 1-7 (2000).

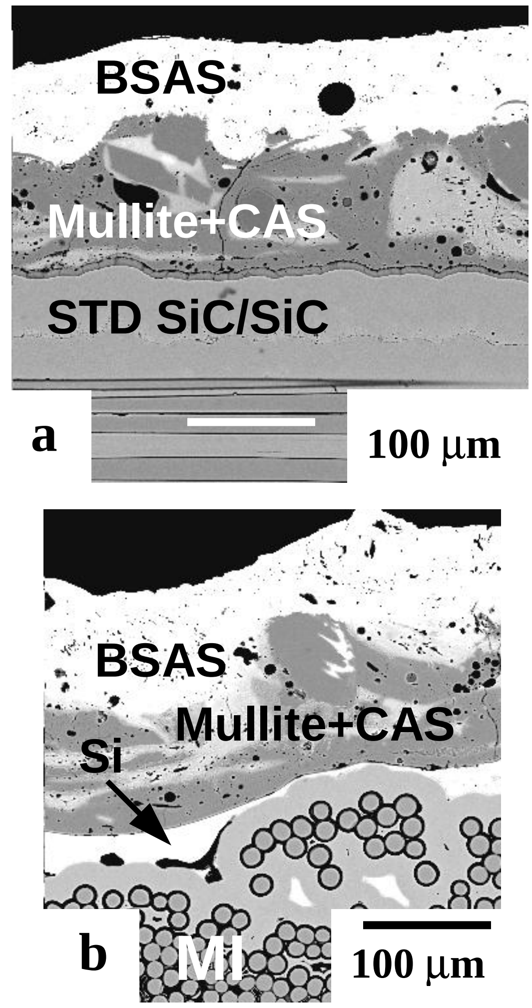

Figure 1. Cross-section of mullite + CAS / BSAS-coated SiC/SiC after 200h at 1225^{o}C with 1h cycles in 90% H_2O-balance O_2: (a) standard SiC/SiC; (b) MI-silicon rich

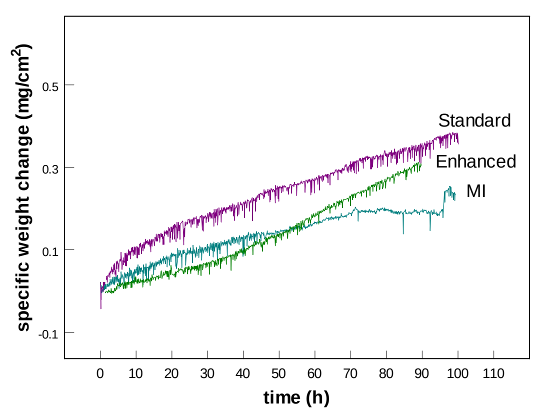

Figure 2. Specific weight change of mullite + CAS / BSAS-coated SiC/SiC in TGA at 1225^{o}C in 50% H_2O-balance O_2.