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Anti-oxidation modification behaviors and mechanisms of ZrB_2 phase on Si-based ceramic coatings in aerobic environment with wider temperature region

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Abstract

To improve the modification effect of ZrB_2 phase on Si-based ceramic coatings in aerobic environment with wider range of temperature, ZrB_2 was utilized to modify the SiC coating by the technique of liquid phase sintering. The modification behaviors of ZrB_2 phase on oxidation inhibition ability of SiC coating were investigated in wider range of temperature through the TG oxidation tests (room temperature-1773K). When the synthetic temperature is 1700□, pure phase ZrB_2 powders were synthesized through the way of carbothermal reduction, the average particle size of which is 531nm. The SiC coating modified by ZrB_2 is comprised of ZrB_2 and SiC phases, the thickness of which is about 200 μm. With the modification of ZrB_2 phase, the oxidation resistance of the SiC coating is significantly enhanced, especial the temperature region below 1200□, leading to the delay of initial mass loss temperature (about 260□) and slowing down mass loss rate (reduced by about 67%) in the fastest mass loss area. While the final mass loss of the coated graphite substrate decreased from 18% to 5%. Owing to the formation of the protective B_2O_3, the fast weight gain temperature region (from 700□ to 1240□) in the TG curve of the ZrB_2 powders effectively compensate the weakness of the SiC