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Effects of polymer derived SiC on the microstructure and properties of C/ZrC composites prepared by reactive melt infiltration

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Polymer derived SiC matrix was introduced into C/ZrC composites, which were prepared via reactive melt infiltration (RMI) of zirconium into C/C preform, to improve its mechanical properties and erosion resistance at high temperatures. After polymer infiltration and pyrolysis (PIP) process, the density of the composites increased from 3.06 g/cm^3 to 3.17 g/cm^3 and the porosity decreased from 9.20% to 3.80%. SiC matrix mainly distributed at the surface of composites, but defects decrease and increasing interface strength of the composites during PIP process resulted in the remarkable increase of rigidity and strength. The flexural strength and modulus increased substantially from 182 MPa and 12.8 GPa to 289 MPa and 38.2 GPa, respectively, and the fracture toughness also increased from 5.4 MPa-m$^{1/2}$ to11.4 MPa-m$^{1/2}$. The oxidation resistance of C/ZrC composites at 1600°C was enhanced with PIP-SiC, but the linear recession rate rose from 0.004 mm/s to 0.009 mm/s after introduction of PIP-SiC.

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