

ULTRA HIGH TEMPERATURE CERAMIC COMPOSITE MATERIALS

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Ultra-high temperature ceramics (UHTCs) are materials that have been demonstrated to withstand temperatures up to around 3000°C, thermal fluxes of ~17 MWm⁻² and gas velocities of around Mach 0.6. Thus, they offer potential for use in applications such as leading edges and engine parts for hypervelocity vehicles. Under the Domain 8 of the MCM-ITP (Materials and Components for Missiles – Innovation and Technology Partnership) programme, research has been carried out investigating UHTC composites consisting of carbon fibre (Cf) preforms impregnated with HfB₂ powders. Whilst the initial impregnation route resulted in preforms with high and uniform powder loadings, this was not true for large samples. As a result, the mechanical properties showed a high degree of scatter. Nevertheless, samples with higher final densities showed higher strengths. Thus a new impregnation route has been developed that results in both higher and more homogeneous powder loading. This has led to higher strengths and even greater temperature and ablation resistance with the only penalty being an increase in component mass. A prototype jet vane has been successfully produced.