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Ceramic Routes to SiC/SiC Composites for Fusion Applications

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The production of SiC/SiC composites with the properties required for fusion application is a complex, multi-stage process. The CVI and PIP techniques result in very low-activation materials but with unacceptable residual porosity. On the other hand, the NITE method produces a dense material with good mechanical properties, but the used sintering additive used can make a considerable undesirable contribution to the activity of the material.

This paper will present an alternative approach to the production of SiC/SiC composite using a ceramic processing route. In the investigation, special attention was given to the selection of low-activation sintering additives that enable densification of the matrix material at moderate temperatures, i.e., below 1500°C. The compositions were tailored with respect to the calculated activation in a fast-neutron flux and taking into account the thermal stability of the available SiC fibres. The technique comprises infiltration of SiC-fiber perform with a colloidal suspension of micron- and nano-sized powders mixture and in the second stage infiltration with sintering aids based on MgO(Al\textsubscript{2}O\textsubscript{3})-SiO\textsubscript{2}-P\textsubscript{2}O\textsubscript{5} system.

With the aim to minimize the amount of secondary phase in the matrix material, the powders were coated with a thin layer of MgO or Al\textsubscript{2}O\textsubscript{3}. A combinatorial approach where the SiC-infiltrated perform is further densified with CVI will also be presented.

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