Synthesis of ultra-high temperature nanoparticles and nanowire ceramics for spatial applications

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Abstract
We are investigating different synthesis routes to produce elemental bricks for the manufacture of ultra-high-temperature ceramic matrix composites for space applications. The aim is to produce materials of controlled composition and size, in the form of nanoparticles and fibres, which can then be assembled to form ceramic matrix composites.

The aim of these materials is to improve both their mechanical strength and their resistance to high temperatures in ablative atmospheres, such as re-entry conditions in the Earth's atmosphere. To this end, the different synthesis routes are all based on a two-step process. First, the synthesis routes are based on Zr, B and C precursors that are intimately mixed. Second, such as the polymer-derived ceramics route, a high temperature step allows pyrolysis of the precursors and reactivity to form ZrC or ZrB2.

Figures

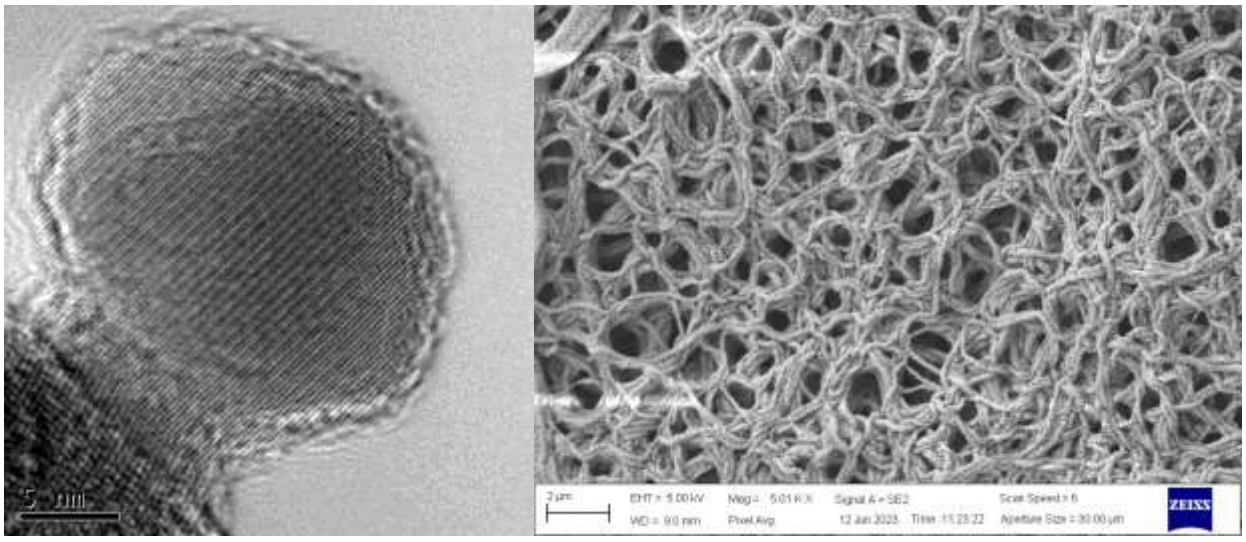

Figure 1: left : ZrC nanoparticles synthesized at 1400°C. **Right** : Nanofibers obtained at 1200°C