Development of a High Temperature Spinning Disc Processor -
Synthesis of Titanium Dioxide Nanoparticles

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Spinning disc reactors exploit the high shear and mixing achieved within the thin films over the surface of a rotating disk to enhance reactions which are sufficiently fast such as to match the residence time of the reactants on the surface of the disk. This technology has proven capable of significantly reducing the duration of chemical synthesis compared to batch processes and provide a means of controlling the shape, size and morphology of synthesized nanoparticles. One limitation of this technology to date is the ability to achieve a high temperature over the surface of the disk whilst maintaining a sharp temperature gradient to the processor wall thereby excluding highly endothermic reactions from being performed on a spinning disk. A spinning disk processor capable of overcoming this limitation was conceived and developed at the Centre for Strategic Nanofabrication (CSNF) in the University of Western Australia.

Anatase phase titania was successfully fabricated using this newly developed high temperature spinning disc processor which represents the first time, scalable spinning disc technology has been successfully applied to such synthesis. The existence of anatase phase titania was confirmed by means of transmission electron microscopy, elemental mapping and electron diffraction. The success of this maiden experiment significantly reduces the length of time necessary for the synthesis of anatase phase titania which previously required lengthy periods of calcination following initial titania nanoparticle formation via batch processes, and the results demonstrate the workability of the setup as a new development in process intensification. It also broadens the scope of application of the spinning disc processor which up until now has been limited by the maximum temperature achievable, typically less than 200°C.