Prof Focke receives dti Technology Award

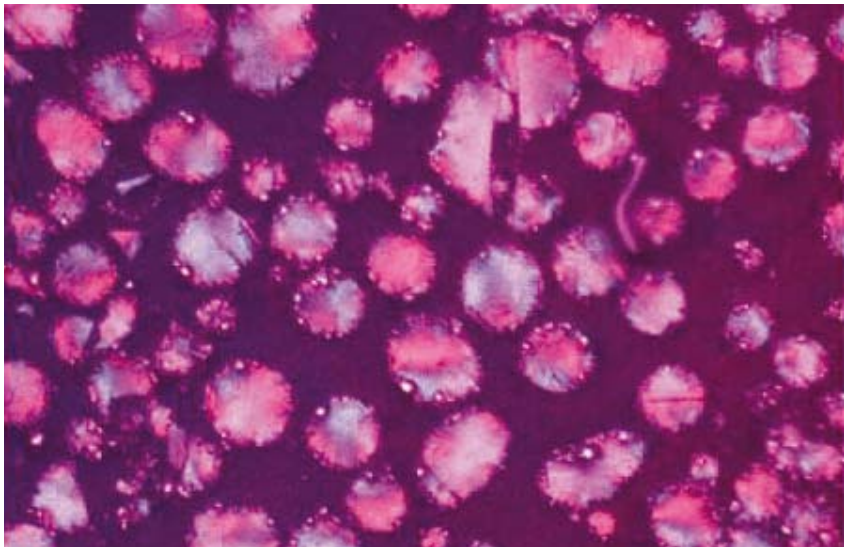
Prof Walter Focke, a professor in the University of Pretoria's Department of Chemical Engineering, Director of the Institute of Applied Materials and incumbent of the Chair in Carbon Technology and Materials, has been recognised for his research performance. He received the Department of Trade and Industry (dti) Technology Award in the category Competitiveness of Technology Partner for the Technology and Human Resources for Industry Programme (THRIP) in October 2009.

The dti Technology Awards is an annual event where South Africa's three innovation and technology programmes – the THRIP Programme, managed by the National Research Foundation (NRF), the Support Programme for Industrial Innovation (SPII), managed by the Industrial Development Corporation (IDC), and the seda Technology Programme (stp), managed by the Small Enterprise Development Agency (seda) – collectively recognise and award national technology innovators. The purpose of the awards is to raise awareness on the benefits of using technology to improve the competitiveness of enterprises. The awards recognise individuals and organisations that contribute towards technology promotion and innovation in South Africa.

The THRIP project of Prof Focke is related to the pebble bed modular reactor (PBMR), which is a high-temperature gas-cooled nuclear reactor (HTGR) with numerous inherent passive safety features. Graphite is the most important material of construction for the reactor core and the fuel pebbles. It acts as structural material and as neutron moderator and reflector.

The objectives of this THRIP project are manifold. The most important is to train and produce scientists and engineers with high-level expertise in graphite technology and materials. This is achieved via postgraduate teaching and research. The research focuses on the local production of nuclear grade graphite from local raw materials, developing mass production techniques suitable for the manufacture of graphite components, the optimisation of material properties, and the characterisation of graphite responses in aggressive environments, e.g. fire scenarios.

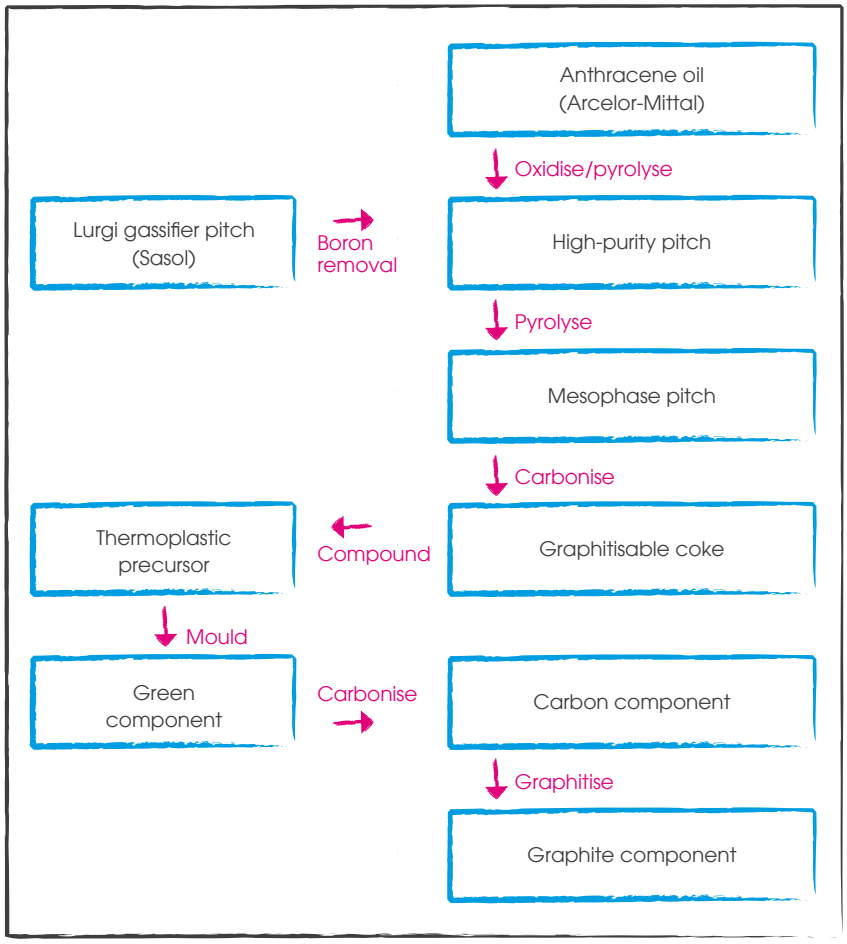
Thus, this THRIP project studies processes related to the manufacture of graphite precursors from local raw materials, their conversion to graphite components and their performance in the final application. Several postgraduate students and their research are supported in part by this THRIP project: Luxolo Holo (PhD) is investigating the synthesis of a pitch from high-purity anthracene oil produced at Mittal. Gedeon Papole (MSc) is looking for ways to remove boron impurities from Sasol pitch. Shatish Ramjee (PhD) is studying mesophase formation in Sasol pitch. Mesophase is a liquid crystalline



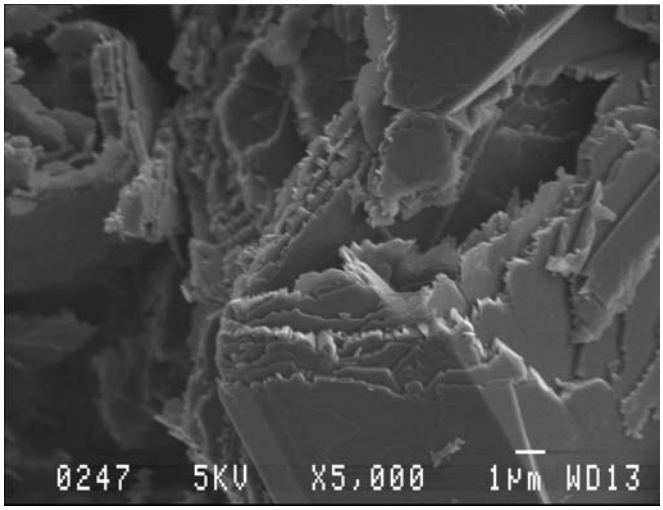
→ *1. Mesophase formation in a South African pitch (Shatish Ramjee).*

graphite precursor. Scebiso Hlatshwayo is adapting graphite compounds to allow conventional injection moulding techniques to be used for the manufacture of components. Heinrich Badenhorst (PhD) is studying graphite oxidation (PBMR accident scenarios include uncontrolled air ingress into the reactor). Knowledge of the high-temperature oxidative stability of the graphite materials utilised in such reactors is required for design and accident modelling purposes.

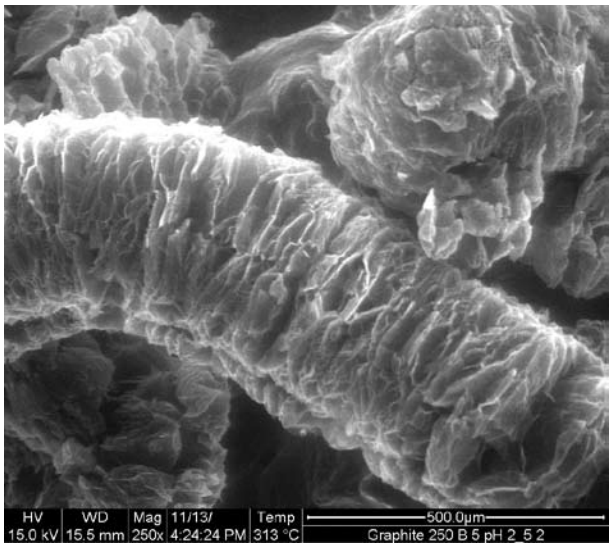
Diagram 1 illustrates the flow path from oil and pitch precursor to final graphite component. Figure 1 shows the partial conversion of a pitch to the mesophase. Mesophase formation is essential, as it is this phase that is ultimately transformed into graphite. Graphitic materials have a very high thermal stability compared to ordinary organics. Figure 2 shows that oxidation is limited to the edges of graphite flakes. Figure 3 shows a picture of an expanded graphite flake produced by heating a special intercalated graphite. The oxidation resistance of this material is so high that it actually finds application as a flame retardant in plastics!



→ ***Diagram 1.*** *Flow chart illustrating the manufacture of a graphite component starting from oils and pitches.*



→ *2. Scanning electron microscope image of the partially oxidised natural graphite at larger magnification with focus on the oxidisation of a specific graphite flake (Hein Badenhorst).*



→ *3. Expanded graphite assuming a 'popcorn' shape.*