Fluorochemical research supports SA's beneficiation strategy

University of Pretoria tasked to develop a fluoro-polymer capability for local industry

THE University of Pretoria's Institute of Applied Materials (IAM) has been tasked to bring existing technology residing at the South African Nuclear Energy Corporation Limited (Necsa) in the field of PTFE, PVDF, FEP and PFA to the University of Pretoria in order to develop a fluoro-polymer capability for local industry.

Prof Philip Crouse who heads the research chair at IMA says that South Africa has fluorspar resources to last 300 years and the technical know-how and commercial expertise to support full scale beneficiation of this mineral.

Mineral beneficiation has been identified as a national priority to create employment and to drive economic growth in South Africa. In support of government policy, the SARChI Chair in Fluoromaterials at the University of Pretoria's Institute of Applied Materials (IAM) has been researching the beneficiation of fluorspar as part of government's Fluorochemical Expansion Initiative (FEI).

> *Most of the research conducted is aimed at developing the South African chemical industry, with a particular focus on conversions, raw material supply, polymer modification and product design for polymer systems and materials*

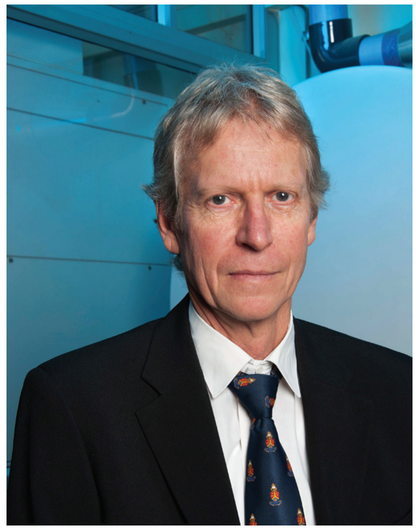
According to Prof Crouse, South Africa has the world's second largest fluorspar (CaF_2) deposits but has exported up to 95% of this high-potential mineral in the past, despite considerable fluorine-related scientific and technological expertise existing locally. To supply the rapidly growing local and export market, the main barriers to market entry, namely the ability to produce hydrogen fluoride and fluorine gas, have long since been crossed by the local nuclear industry and partnerships have been established with several international companies.

Exciting developments in dealing with PTFE scrap

The SARCHI Chair in Fluoromaterials: Science and Process Integration was established in the Department of Chemical Engineering at the University of Pretoria in 2007, and has been functioning under the IAM umbrella since 2010.

One of the most recent research highlights has been in the way industry deals with polytetrafluoroethylene (PTFE) scrap. PTFE, often better known by its DuPont trade name Teflon, which is non-reactive, has a very low coefficient of friction, a very high maximum working temperature and is water repellent.

This is partly because of the strength of its carbon-fluorine bonds. The material has many industrial applications and is often used in containers and pipes for reactive and corrosive chemicals. PTFE in general is not melt-processible and products are cut from large blocks. The scrap produced in the process could not be reused up to now. The Fluoromaterials Chair at IAM has very recently developed a process, an extension of work originally done by Necsa-Pelchem, through which PTFE scrap can be processed and reused as fresh resin.



Prof Philip Crouse who heads the research chair at the University of Pretoria's Institute of Applied Materials

In the process, scrap from this highly versatile material is thermally cracked to produce the constituent monomer in sufficient purity to be directly polymerized - without any additional distillation or further purification steps. The virgin resin has been sintered successfully; in other words, it has been heated to form a coherent mass without melting it. While the process still needs further tweaking, the first results of this technique developed by post-graduate students of IAM have proved to be highly exciting.

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Laser transparency for engine cooling

THE new Ultradur® LUX is being used in an air flap control unit, an unusual serial application in automotive construction. Motor developer Precision Motors Deutsche Minebea (PM DM), based in Villingen-Schwenningen, Germany, is using this highly laser-transparent and easily laser-weldable BASF plastic from the PBT family to make the housing cover of its novel control module. This small actuator consisting of gears, an electric motor and an electronic unit serves to control the air flaps in motor vehicles, thus contributing to better aerodynamics and lower CO_2 emissions. The highly laser-transparent PBT Ultradur LUX accounts for stiffness and dimensional stability, even in damp environments. The product's key characteristic is its high transparency toward near-infrared light in the 800 to 1100 nm wavelength, precisely the crucial range for penetration laser welding. The improved transparency to laser light means that this material can be welded faster than other PBT grades available on the market. The processing window is considerably wider and the risk of damage to the material is much lower. The grade used here, Ultradur LUX B4300 G4, is reinforced with 20% glass fibres.