Tukkie student wins IOM³ world lecture competition

Cornelis van Niekerk, a student in Metallurgical Engineering at the University of Pretoria, won the Young Persons' World Lecture Competition of the Institute of Materials, Minerals and Mining (IOM³) in Hong Kong in October 2013. Van Niekerk, whose paper was entitled "Novel technique for *in situ* laser alloying of AISI 410L stainless steel with nitrogen during laser cladding", is studying towards his master's degree in the Department of Minerals Science and Metallurgical Engineering.

He studied BEng (Metallurgical Engineering) and graduated from the Department of Materials Science and Metallurgical Engineering at the University of Pretoria in 2010. In the same year, the Southern African Institute of Mining and Metallurgy (SAIMM) recognised him for the best final-year project for his work on the sensitisation of ferritic stainless steels during low-heat input welding.

After obtaining his master's degree, Van Niekerk will continue his studies towards a doctoral degree. His current research interests include welding engineering, especially welding metallurgy, as well as laser metal deposition and alloy design through laser alloying to improve the lifespan of continuous caster rolls in the steelmaking industry and turbine blades in the electricity industry in South Africa.

IOM³ is a major engineering institution in the United Kingdom (UK). Its activities encompass the entire materials cycle. This cycle includes the process from exploration and extraction, characterisation, processing, forming, finishing and application, to product recycling and land reuse.

The competition is open to research candidates under the age of 28 years. It is based on research in the fields on minerals, materials, mining, packaging, clay technologies and wood sciences. The candidates are required to present a lecture on their research topic, and they are adjudicated on the basis of their performance during this presentation.

Van Niekerk's paper explained how nickel-alloyed AISI 410L stainless steel is used in applications where components experience high wear rates (for example, rolls used in a continuous caster, where steel is cast) and are susceptible to hightemperature creep (for example, turbine blades). The high cost of nickel, however, makes this alloy an expensive material to use. The current trend to reduce the cost of nickel-bearing stainless steels is to replace the nickel with nitrogen.

The feasibility of replacing nickel with nitrogen (to improve the wear and creep resistance of AISI 410L) was investigated for laser-cladding applications. This novel method of alloying with nitrogen entails the dissociation of Si₃N₄ during the laser-cladding operation (which is the melting of stainless steel powder onto a medium carbon steel substrate) using the heat generated by a laser beam. A change in the microstructure of the cladded layer, with a consequent increase in hardness (and hence wear resistance), was observed.

The competition was held at the Hong Kong Jockey Club and competitors came from Brazil, Hong Kong, Ireland, Malaysia, Singapore, South Africa, the UK and the USA. Finalists enjoyed a few field trips in Hong Kong before the competition. Activities included visits to a recycling plant, a local university, the underground construction of the mass transit railway (MTR) system and a visit to Hong Kong Aero Engine Services Limited (HAESL), a company that specialises in overhauling and repairing Rolls-Royce aircraft engines. They also enjoyed a cruise to Lamma Island. 😣

ightarrow Some of the candidates and IOM³ representatives at the MTR underground construction site.

 \rightarrow The candidates and IOM³ representatives at the HAESL facilities, in the testing cell where the engines are tested after being overhauled.

The Institute of Materials, Minerals and Mining HONG KONG BRANCH

→ Top right, below left and right: Candidates at the Hong Kong Jockey Club on the day of the competition. Bottom right: All the delegates from the countries that were represented in the competition.

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