Supporting collaboration between the public and private sector has been shown time and time again to yield excellent results. We spoke to FIMECC programme manager and Spinverse senior consultant **Dr. Markku Heino** about how the Finnish Metals and Engineering Competence Cluster (FIMECC) has been driving innovation and providing top-end solutions to critical industrial problems

Driving innovation in the metals and engineering sector

FIMECC was established in Finland in 2008 as a special public-private partnership in the area of metals and engineering. It was designed to carry out long-term cooperative research through target-oriented industry-led and precompetitive programmes in fields most crucial for the future. The results of these have been excellent, providing breakthrough innovations of global importance.

Currently, FIMECC runs several different Breakthrough Materials Programmes that aim to provide added value to innovation activities within several strategic areas. The FIMECC DEMAPP programme aims to improve understanding of wear, corrosion, friction and fatigue mechanisms in the demanding applications often involved in the process and energy industry, as well as developing novel breakthrough materials with improved performance in these extreme conditions. Programme participants include 26 companies, their supplier and customer companies as well as 11 selected high-level research groups from 5 different institutions.

Raex wear-resistant and ultra-high-strength steels

One example of the work undertaken in FIMECC DEMAPP is the development of Raex wear-resistant and ultra-high-strength steels by steel manufacturer Ruukki. Using their own technological innovation of direct quenching, new abrasion resistant steel families have been created. Working together with the University of Oulu, Tampere University of Technology and Metso Corporation, the company has been able to optimise the chemical composition of these steels so that they significantly extend the lifespan of machinery in which they are used, reducing the cost and ecological footprints of the relevant components. Different thicknesses ranging from 2-80mm have been developed, with the lightweight products being used to increase energy efficiency in the transportation industry, while the thicker grades are used mainly in buckets and mining machines.

Nickel-free corrosion resistant steels

The high and fluctuating price of nickel has been affecting the steel industry in recent years, and there has also been a marked shift towards the use of ferritic stainless steel grades over austenitic stainless steels. Outokumpu, a global leader in the production of high performance stainless steel, has collaborated with the University of Oulu and Aalto University to push forward the state-of-the-art knowledge in high-chromium ferritic stainless steels. Ferritic stainless steel grades are moving into more demanding applications requiring higher chromium contents. The 21% chromium stainless steel grade (Outokumpu 4622) developed in this research has been shown to have both excellent corrosion resistance and to be ideal for deep-drawing applications. This gives this novel stainless steel grade a broad range of potential uses, from outdoor wall panels, roofing and exhaust systems, to catering and household equipment.

Thermally conductive cast aluminium compounds

In electronic and electro-technical applications - electronic housings, base stations, heat sinks, inverters etc. - the demand on heat removal properties is high. The thermal conductivity of the cast alloy must be high enough so that heat is dissipated at a high rate, otherwise component failures and disturbances in operation can occur. Alteams and Aalto University have worked in close cooperation to find possible ways, such as optimisation of alloy composition and heat and melt treatments, to improve the thermal conductivity of aluminium

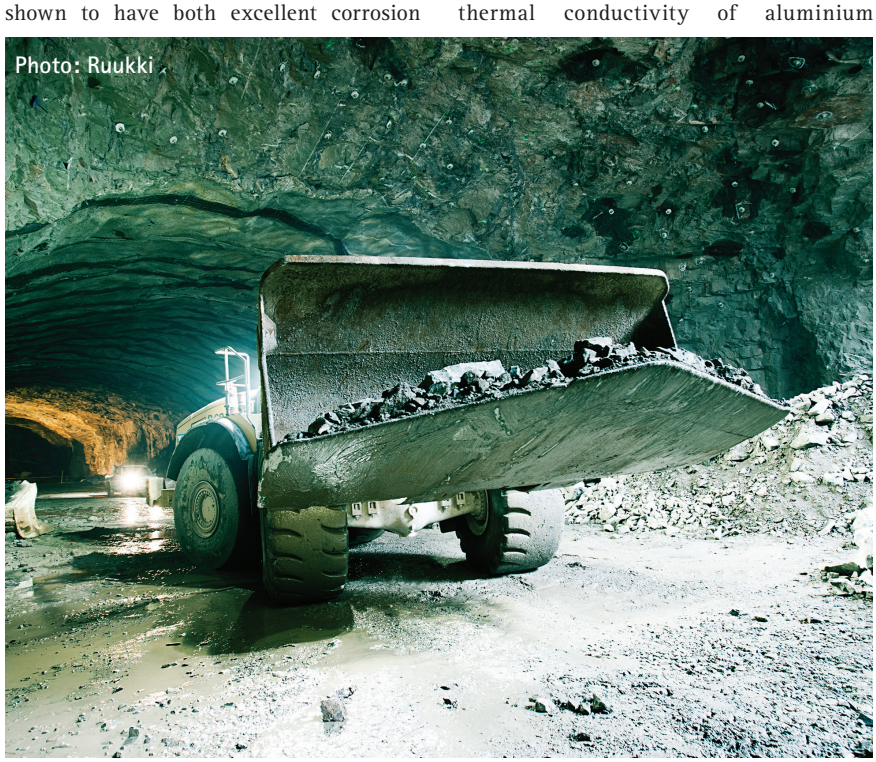
Photo: Ruukki

castings, especially aluminium die castings. Setting themselves a target of improving the conductivity from 120 W/mK up to 190 W/mK, they managed not only to achieve this but also to reach 207 W/mK with their castable primary low silicon alloy. Such an improvement in heat transfer guarantees not only high-performance of devices, but also longer lifetime and significant energy and cost savings.

Innovation environment

Part of FIMECC DEMAPP's success is based on the presence of the right partners. A number of these partners are global companies, extending the R&D exercise beyond Finland and bringing in expertise worldwide. As well as this, encouraging an environment in which companies are willing to collaborate properly is crucial, as Dr. Markku Heino, senior consultant at Spinverse and programme manager of the FIMECC DEMAPP, explains: "Very often companies are reluctant to work with other companies who might end up being their competitors. That is why we focus on pre-commercial and precompetitive work. However, it is also important to ensure that the research agenda is right: focused enough so that the industry partners will gain real benefit from the solutions to critical problems, but also challenging enough so that the scientific partners are pushing themselves into unknown and thought-provoking lines of research."

The subject matter of the programme itself is not unique; in fact, there are many others around the world working in similar areas, but it is this crucial factor of having the right balance of industrial end-users on one side, and materials specialists with the right know-how and equipment to carry out the necessary experimental research and modelling on the other, that sets FIMECC DEMAPP apart. With more than one hundred researchers actively working together in this way, it is no surprise that the programme has proven fruitful.

> "It is crucial to have the right balance of industrial end users and material specialists"

The road ahead

The DEMAPP programme is coming to an end this year, but the next generation of work is already in progress. Building upon some of the previous work addressed in FIMECC, but mostly based on new industrial needs, two new five-year research programmes led by Spinverse began this year. The first of these is Breakthrough Steels and Applications (FIMECC BSA), which will include stakeholders from across the entire steel value chain to help provide a boost to the Finnish metal and engineering industries. The other is called Hybrid materials (FIMECC HYBRIDS), which will be looking to combine common and novel engineering materials in innovative ways, serving the needs of several selected applications.

Bringing new talent to work in environments that bring them into proximity with industrial and academic leaders is a vital step in providing a bright future for Finland's industry, and this is reflected in the new programmes by the inclusion of the FIMECC Breakthrough Materials Doctoral School. This will provide space for 30 doctoral students who will be given the full support from all partners involved. "Training this amount of people is a big investment, which I think is a testament to how seriously we take this side of things," states Heino. "We want to nurture these people to create something new and fresh."

Heino believes that the new public-private partnership programmes will help to build the competitive edge of companies involved, while at the same time help to provide environmentally sound solutions to industrial problems. "If you look at recent EU documentation, one thing that is talked about a lot is finding sustainable cleantech solutions that help Europe to respond to the societal challenges that we are faced with today. We are building on that talk and providing tangible answers to these challenges."★

AT A GLANCE

Project Information

Project Title:
FIMECC DEMAPP: Demanding Applications

Project Objective:
FIMECC DEMAPP is an industry-led public-private partnership program running application-driven R&D of advanced materials for extreme service conditions. The target is to tackle critical wear, corrosion, friction and fatigue related challenges and develop novel breakthrough materials solutions for the demanding applications in e.g. process, energy and engineering industry.

Project Duration and Timing:
5 years, 2009 to 2014

Project Funding:
Participating companies and Tekes, the Finnish Funding Agency for Innovation, 37 MEUR

Project Partners:
26 companies from Finnish metals and engineering industry and 11 research groups from 5 universities/research institutes

MAIN CONTACT

Dr. Markku Heino
Markku is specialized in materials technology and innovation management with wide experience from scientific research to application-oriented R&D of new materials in many industrial applications. As builder and manager of several large target-oriented industry-academia joint R&D programmes he is creating new ecosystems, multidisciplinary competences and critical solutions needed to renew industries.

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