Media release

Materials Science & Technology

Dübendorf, 28 February 2006

New head of Materials and Engineering Section

Strong bond with Empa

Dr. Giovanni P. Terrasi took over as head of Empa's Materials and Engineering Section on 1 December 2005. After studying materials engineering at the Swiss Federal Institute of Technology (ETH) in Zurich, he earned his doctorate under Empa's present Deputy Director, Prof. Urs Meier. After eight years in the private sector, Terrasi now brings to Empa a broad-based expertise in the field of fibre composites.

In his capacity as head of research and development, engineering and quality assurance at structural fabricator SACAC AG in Lenzburg, Ticino-born Terrasi demonstrated his ability to translate innovative research ideas into marketable products. At SACAC, Terrasi and his team managed to produce heavily constructed elements from self-compacting high-performance concrete and create new products using filigree, corrosion-resistant, carbon-fibre-prestressed concrete sections. He now intends to exploit his in-depth knowledge of composites and engineering, honed through several years of practical experience in a production facility, to intensify the Materials and Engineering Section's collaboration with industry.

Materials and Engineering remit

Formed in April 2005, this relatively new Empa section carries out innovative projects in the following research and development areas:

Smart structures

New materials capable of serving as actuators and/or sensors are used to develop smart structures which lend themselves to mechanical engineering, transport or medical applications. Active fibre composites (AFC) and electroactive polymers (EAP) represent two focal technologies. The section's aim is to build interesting prototypes and technology demonstrators, such as a six-metre-long EAP blimp to be developed over the next two years. This is designed to showcase the bionics-inspired undulating locomotion concept – similar to the flapping action of a fish in water – to the expert community and a wider audience. This type of low-noise airship would be ideally suited for carrying television equipment, e.g. for sports transmissions. Moreover, a single airship of this kind would offer

the capacity to handle all mobile phone calls in the London conurbation, thereby making countless radio masts redundant.

Biomedical engineering

Here, research centres on the mechanical performance of newly developed biocompatible products, biomaterials and surgical implants. Partnered by industry, the section works on improving orthopaedic components. Specific projects have focused on the application of the finite element method in optimizing the design of an intervertebral disc replacement, in collaboration with implant manufacturer Synthes, and the development of a simplified spine simulator for vibration durability testing under real ambient conditions. New projects involving Terrasi's team and other Empa departments will investigate the application of hard, long-term-stable carbon surface layers to artificial joints. The section is also collaborating with colleagues at Empa in St. Gallen in the design of innovative hip protectors for the elderly using fibre composites and polymer foams.

Composites

In addition to the industry-oriented development of components and experimental checks on elements and prototypes, activities in the field of *composites* focus on materials engineering innovations: one new research project deals with the use of nanoparticles to increase the fracture toughness of epoxy. A composite comprising clay nanoparticles and carbon nanotubes in an epoxy matrix for glass- or carbon-fibre-reinforced laminates is intended to enhance the impact strength and fire resistance of fibre composites.

Mechanical structures

The impact of static and/or dynamic loads on mechanical structures made of metal, polymers or composites is of crucial importance in a wide variety of applications. The results of related investigations serve both to demonstrate serviceability and operational durability and to facilitate design improvements. Close contacts with Swiss SMEs allow joint R&D projects to be implemented in the fields of lightweight construction and operational durability (e.g. involving the combination of fibre composites with metal). The activities in this area make a major contribution to the high standard of a services provided for Swiss industry. These include surveys into failures such as the track cable fracture on the Schilthorn cableway in December 2004, which last year culminated in the preparation by Empa of new monitoring regulations for aerial ropeway cables.

Complementary services

The Section's research and development activities continue to be supplemented by an attractive range of top-notch technical services for industry and the public sector. Examples include surveys into the operational durability of aerial ropeway structures, monitoring of the structural and prestressing steel providers operating in Switzerland (SIA register), measurement of service loads acting on transport vehicle components and sophisticated mechanical tests on plastics piping systems.

Giovanni Terrasi's verdict so far: "After only two months in the Section, I am very confident that, given the in-depth expertise and unstinting commitment of the team, our work in the field of materials and engineering for innovative devices can meet the ambitious targets that have been set. We are in for a thrilling time!"

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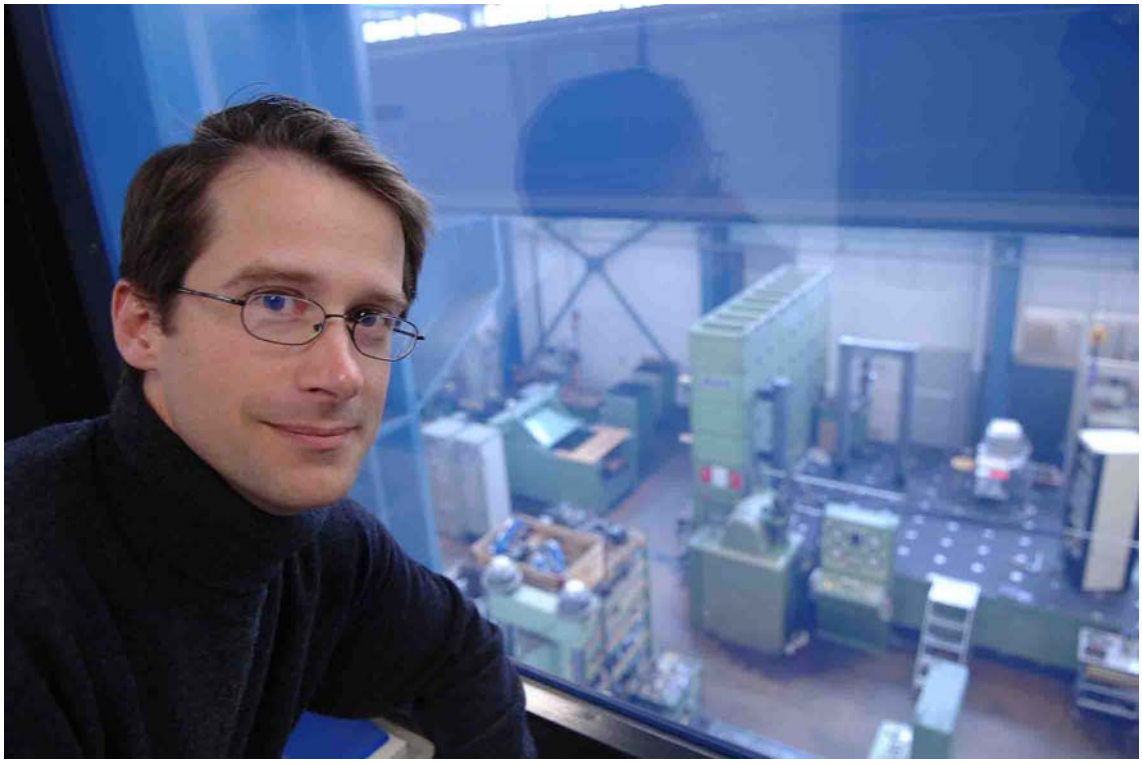

As Head of the Materials and Engineering Section, Dr. Giovanni Terrasi is confident of meeting the ambitious targets with the support of his team. Home to the section is the "metal shed", pictured in the background, at Empa's Dübendorf site.

The images are obtainable in electronic form from remigius.nideroest@empa.ch