Media communiqué

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New head –- and new orientation – for Empa's Solid State Chemistry and Analyses Laboratory

Novel functional materials for alternative energies in their sights

«Most discoveries are made by chance. Our aim is to make intentional, controlled changes to a material's properties, but still leave enough freedom for things to happen by chance.» This is how Anke Weidenkaff, head of Empa's Solid State Chemistry and Analyses Laboratory since May 1st, describes her method of developing new functional materials for energy conversion and environmental technology.

It happened at a scientific conference. Anke Weidenkaff fell into conversation with some solar chemists, was fascinated by what she heard from them, and knew instantly that alternative energy sources was the only research area for her. Since then Weidenkaff, who studied chemistry in Kiel and Hamburg, has devoted her time to investigating various solid-state materials which can transform one form of energy into another. After completing her doctorate at the Paul Scherrer Institute (PSI) in Villigen and the ETH Zurich, followed by a post-doc position at the solar research institute of the Centre National de la Recherche Scientifique (CNRS) in Font-Romeu, France, she completed her «Habilitation» qualification for professorship at the University of Augsburg and was then appointed Visiting Professor at the University of Caen.

From Group Leader to Head of Laboratory

At Empa she built up the very successful Solid State Chemistry group, the first team in Switzerland to begin the development of novel perovskite-based thermoelectric materials. This work went «Very well!» reports Anke Weidenkaff. «After just a short time in the field we have begun to play an important role in perovskite research, and have already organized an international conference on the subject.» Perovskites are ceramic materials which possess a special crystal structure making them suitable, among other things, for use in converting mechanical or thermal energy (i.e. heat) into electric current. They are very much the centre of attention at the moment, with over 2500 publications on them appearing annually in renowned scientific journals, making them currently one of the most important classes of material in chemistry.

Early in 2006, after an international selection process, the Empa management appointed Anke Weidenkaff to Head of the Solid State Chemistry and Analyses Laboratory. There is not much difference between the new position and her old one as Group Leader, she maintains, one hundred

days after beginning the job. «The most important thing for a laboratory is that the team is motivated and works well together. There's no doubt that my staff meet these requirements absolutely, and we can rely on each other totally.»

Materials research for the benefit of the environment

The name of the laboratory says it all. «Solid state chemistry is the source on which the development of applications and material design for energy conversion and environmental technology is based,» explains the new laboratory head. «Only when we understand the fundamental properties of materials can we make new substances with the particular characteristics we want.» The investigation of the structure, properties and interactions of materials is the common thread which binds the three groups in the laboratory – Solid State Chemistry, Solid State Analyses and Solid State Catalysis – together.

An important research area is the «tailor-making» of energy conversion materials, which can, for example, transform the warmth of the sun's rays into electrical energy, or electrical into chemical energy. This energy conversion process is made possible by the movement of electrons or ions which act as energy carriers. Anke Wiedenkaff and her coworkers are investigating how these charged particles are transported in various solid state materials, and how this process can be controlled. They are studying novel substances developed at Empa with perovskite structures and carbon nanotubes. «The challenge is for us to exploit a material's contrasting properties of reactivity and stability in an optimal way,» enthuses the chemist. Very promising in this respect are so-called mesoporous materials, having pores with sizes between 2 and 50 nanometers. Thanks to their fine pores, these materials have an enormous surface area, which makes them eager to react. Since they are at the same time stable, they lend themselves to converting chemical energy from redox reactions (such as occur in fuel cells) into other forms of energy.

The Catalysis Group is investigating how the emission of pollutants caused by human activities can be reduced or even prevented. In pursuit of this aim, they are searching for new materials and technologies to enable the cleaner combustion of natural gas, and alternative materials to the noble metal catalytic converters used in vehicles. This is because palladium, platinum and rhodium – the noble metals currently used in catalytic converters – are scarce and therefore very expensive raw materials. According to Anke Weidenkaff, perovskite materials represent a possible alternative in this context.

The newly oriented laboratory is very well networked, and not just within Empa. In addition to joint projects with the PSI and the Laboratoire de Cristallographie et Sciences des Matériaux (CRISMAT) in Caen, contacts exist with the University of Augsburg and a cooperative project with the Prague Academy of Science is just getting under way.

The pleasure of training tomorrow's researchers

At the moment Anke Weidenkaff is supervising four doctoral students, from Spain, France, Belarus and Russia, as well as an undergraduate student working on her final-year project. «I enjoy working with my students a great deal, and the youngsters are doing very well,» she says. «Since doctoral students at Empa do not have to supervise undergraduate laboratory courses, they have time to take on other work in addition to their PhD projects.» They create and organize seminars and hands-on workshops at Empa, for example, in which new methods of characterizing solid state materials or working with new computer programs are discussed. This also gives the young researchers an opportunity to talk to invited experts about their doctoral work.

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Dr. Anke Weidenkaff, Head of the newly reorganized Solid State Chemistry and Analyses Laboratory at Empa