

Fields of Expertise

TU Graz's research activities are grouped into five strategic, forward-looking Fields of Expertise. Researchers engage in interdisciplinary cooperation and benefit from different approaches and methods, shared resources and international exchange.

● Advanced Materials Science

Editorial: Anna Maria Coclite,
Christof Sommitsch,
Gregor Trimmel

**A Sprinter that Runs on Water:
Energy Storage with
Hybrid Supercapacitors**

Qamar Abbas

● Human & Biotechnology

Editorial: Gernot Müller-Putz

**CO₂ and Lignocellulosic Biomass
as Feedstocks for Upcoming Bio-
technology**

Regina Kratzer

● Information, Communication & Computing

Editorial: Kay Uwe Römer

**Modelling, Simulation and
Optimization of Complex
Technical and Medical Systems**

Manfred Kaltenbacher

● Mobility & Production

Editorial: Helmut Eichlseder

**High Frequency Data Capturing
for Process Innovation with
Machine Tools**

Rudolf Pichler

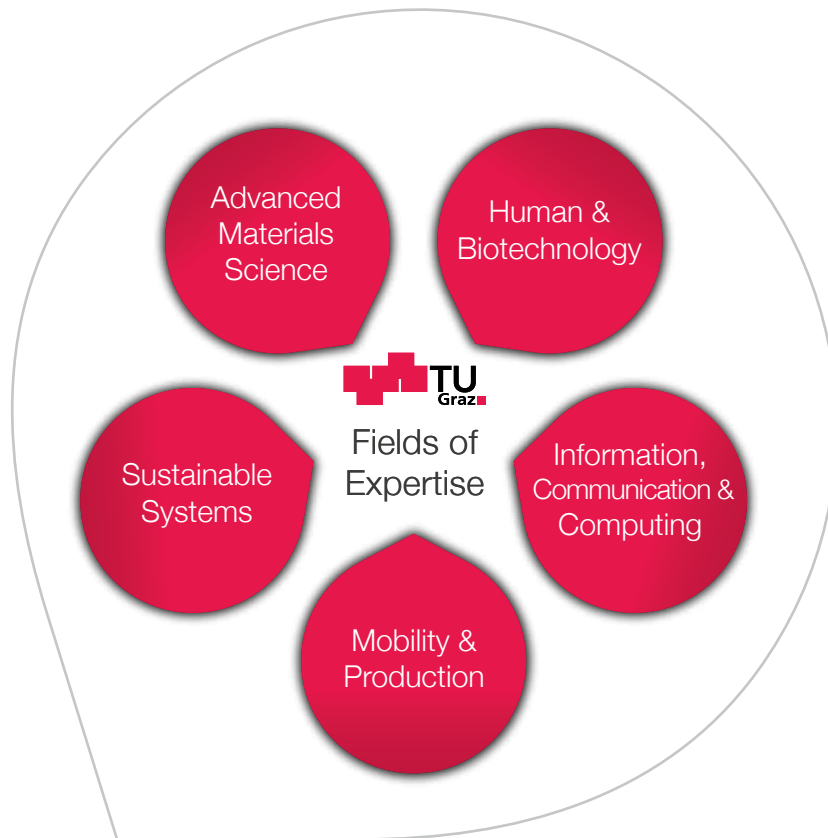
● Sustainable Systems

Editorial:

Urs Leonhard Hirschberg

**Residence-Based Mobility
as a Starting Point for
Sustainable Cities**

Aglaée Degros,
Markus Monsberger



TU Graz has divided its research into five innovative areas: the Fields of Expertise. Researchers in the Fields of Expertise break new ground in basic research. They take part in interdisciplinary cooperation, gain support for outstanding projects and are based in the region as well as part of international networks. They also develop key technologies for industry and commerce, and perform research in the framework of company shareholdings and partnerships.

Source: TU Graz

● **ADVANCED MATERIALS SCIENCE**

Researchers aim to understand the smallest components in the structure and function of new materials, and develop and assemble them in special processes.

● **HUMAN & BIOTECHNOLOGY**

Researchers develop devices and methods for medical applications and therapies, and focus on using enzymes and living microorganisms such as bacteria, fungi and yeast in technical applications.

● **INFORMATION, COMMUNICATION & COMPUTING**

Researchers face challenges prompted by the information age, for example data security and efficient use of the ever-increasing volume of data.

● **MOBILITY & PRODUCTION**

Researchers investigate novel vehicle technologies, new drive systems and more economical product manufacturing processes.

● **SUSTAINABLE SYSTEMS**

Scientists focus on the complex challenges presented by a growing population and increasingly scarce natural resources.



ADVANCED MATERIALS SCIENCE

Fields of Expertise TU Graz

Source: istockphoto.com



**Anna Maria Coclite,
Christof Sommitsch,
Gregor Trimmel,
Advanced Materials Science**

Source: Lunghammer – TU Graz

Covid-19 has not limited the productivity and creativity of the Field of Expertise Advanced Materials Science. Although still restricted in our daily laboratory work, many of our members have used the time working from home to write scientific papers or apply for research funds. In the 14th call of the initial seed funding programme of TU Graz, we were able to finance

four interesting project ideas in chemistry, physics, mechanical engineering and electrical engineering. The awardees were Andreas Drexler with a project on hydrogen embrittlement of dual-phase steels, Ilie Hanzu working on in-operando characterization methods of ion transport in solids, Annette Mütze with an interdisciplinary project idea on laser cutting technologies, and Matiss Reinfelds on a new class of organic semiconductors for solar cells. We wish them good luck for the proposal submission, and we look forward to your submissions for the next call.

In order to foster networking of the Field of Expertise despite the Covid-19 pandemic, we carried out the FoE AMS *update* for the first time to inform our members about the latest news within the Field of Expertise, to discuss current topics and to present exciting research projects. In the

first edition, Birgitta Schultze-Bernhardt presented her ERC-starting grant project ELFIS – Electronic Fingerprint Spectroscopy and Gerald Kothleitner the project ANGSTROM – A Next Generation Scanning Transmission electRON Microscope for multidimensional imaging and fast spectroscopy within the FFG infrastructure call. The FoE AMS *update* will be held four times a year, online or in person, depending on the Covid-19 situation.

Finally, Qamar Abbas, Christian Prehal and their coworkers have gained interesting new insights regarding the persistent and reversible solid iodine electrodeposition in nanoporous carbons, which was recently published in Nature Communications and will be the topic of the next few pages. This is another example of vivid research activities within the Field of Expertise on energy materials. ●

Qamar Abbas:

A Sprinter that Runs on Water: Energy Storage with Hybrid Supercapacitors

Peak power demand puts a lot of pressure on primary electricity sources (grid or off-grid renewables) as well as on electrical equipment. Supercapacitors are the perfect solution for peak power saving as they deliver bursts of energy and then quickly capture excess power that is otherwise lost. Water-based supercapacitors can serve this purpose at low cost per kWh. >

Among various electrical energy storage devices for industrial and electric grid applications, supercapacitors are the most promising ones owing to their high pulse power, rapid charge/discharge (in milli-

seconds), high efficiency and extremely long cycle life [1]. At the heart of this fast charge storage is porous activated carbon as electrode material with a surface area up to 2,000 m² g⁻¹. High specific surface >



Qamar Abbas obtained his PhD (Dr. techn.) from the Graz University of Technology and completed his habilitation at the Poznan University of Technology, Poland in 2018. Currently, he is a Lise Meitner fellow with Bernhard Gollas at the ICTM and his research is focused on supercapacitors and hybrid energy storage devices.

Source: Qamar Abbas