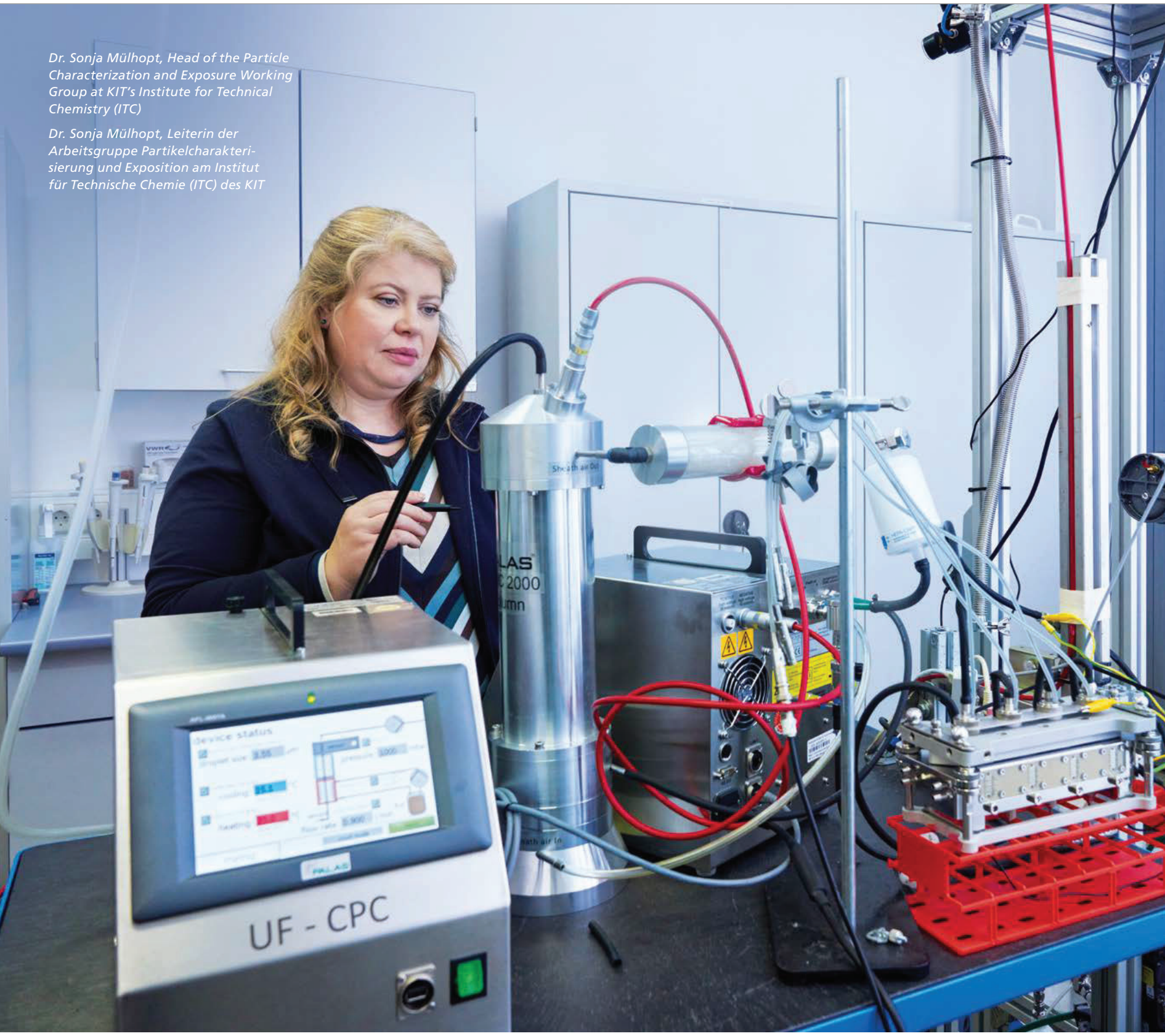
Developing Products and Doing **Research** at the Same Time – Is that Possible? **Of Course**, It Is!!



Dr. Sonja Mülhopt, Head of the Particle Characterization and Exposure Working Group at KIT's Institute for Technical Chemistry (ITC)

Dr. Sonja Mülhopt, Leiterin der Arbeitsgruppe Partikelcharakterisierung und Exposition am Institut für Technische Chemie (ITC) des KIT

DR. SONJA MÜLHOPT IS WORKING ON TECHNOLOGIES FOR THE EVALUATION OF AIR POLLUTANTS

BY REGINA LINK // FOTOS: AMADEUS BRAMSIEPE
TRANSLATION: FACHÜBERSETZUNGEN HUNGER/ALTMANN GBR

Chemical engineer Dr. Sonja Mülhopt is a classic example of how even a zigzag career path can take you to your goal. Given her practical nature, the only option when she was in her mid-20s seemed to be a career in industry. However, she ended up at KIT, where she has remained ever since. As Head of the Particle Characterization and Exposure Systems Working Group at KIT's Institute for Technical Chemistry (ITC), she is developing systems for the evaluation of air pollutants. Her third patent is soon to become a product.

Dr. Sonja Mülhopt started out as a chemical engineering student at the former Karlsruhe University. But she soon realized that practice suited her better than theoretical work. She started a dual education program at the former Karlsruhe Research Center and the Berufsakademie Mannheim (today Baden-Wuerttemberg Cooperative State University). There, things went well, she enjoyed what she was doing and realized she was among those who take "hands-on" literally.

Mülhopt was sure then: "A facility, a laboratory, or a production site is the place for me. I will continue my way in industry." But then she got involved with technology transfer. At that time, Dr. Silvia Diabaté from today's Institute of Biological and Chemical Systems – Biological Information Processing (IBCS-BIP) at KIT was searching for a method to apply particles from exhaust fumes to human lung cells to observe their reaction to these pollutants. The aerosol part of this concept was an ideal subject for Mülhopt's diploma thesis – and the first step in developing her passion: Applying research into practice.

From the First Product to a Surefire Success

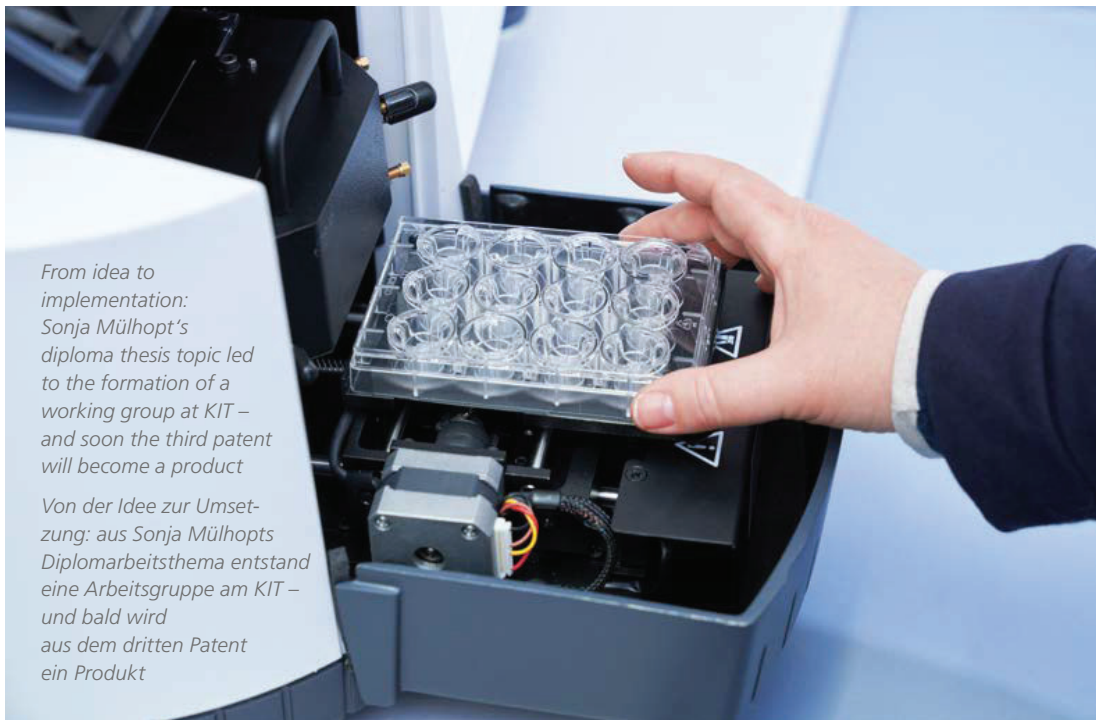
To investigate how pollutants affect lung cells, researchers once had to observe cell cultures. This procedure, however, did not correspond to natural breathing. A different method was needed to study the reaction of cells to airborne particles. The first approach developed by Mülhopt only worked for gases, not for pollutant particles. "If my students today start to fall into despair, I ask them to read my thesis. It explains in 60 pages that it doesn't work this way." But even a negative result is a result. "It depends on what I make of it. This diploma thesis has spawned a workgroup and an entire field of work," she said. In the end, it did work.

Since then, Mülhopt's working group "Particle Characterization and Exposure Systems" has greatly progressed in its scientific findings and methodology, together with collaborative partners from the IBCS. The researchers developed methods to replicate the ambient conditions of particles when they are inhaled and transported through the lungs. They use a measuring cell in which lung cells are exposed to the pollutants in a manner that approximates the natural process of inhaling them into the lungs. It is even possible now to set and measure the amount of pollutant exposure live in this testing system. And when the third patent becomes a product, it will be possible to measure the damage caused to the cells directly during exposure. So far, lung cells still need to be extracted and then be examined in a lab.

Right from the start, Dr. Sonja Mülhopt has worked in close cooperation with the biotech company VITROCELL® Systems GmbH. "I greatly enjoyed developing the first product back then," she recalled. The rest came naturally. "We had a sensing system that was able to measure nanoparticles, and the technology to conduct toxicological studies," she added. Other major EU projects were to follow.

Heading out for the Next Projects after Earning Her Doctorate

When she was in her mid-30s, Mülhopt decided to pursue a doctorate and thus turned fully to science. For this, she needed another



From idea to implementation: Sonja Mülhopt's diploma thesis topic led to the formation of a working group at KIT – and soon the third patent will become a product

Von der Idee zur Umsetzung: aus Sonja Mülhopts Diplomarbeitsthema entstand eine Arbeitsgruppe am KIT – und bald wird aus dem dritten Patent ein Produkt

master's degree. However, this would have meant returning to the lecture hall – as a 37-year old group leader with 12 years of experience as a researcher! This situation was sobering and inspiring at the same time. She would soon find out that learning does not become easier with age. On the other hand, she was eager to update her technical knowledge. "When I started my studies, CAD was still a thing for designers; we worked at the drawing board." So, she acquired knowledge about digital tools. It took some time until she earned her doctorate, but last year, soon after her 50th birthday, she could add this title to her business card.

It is obvious that Mülhopt will not run out of work. Whether it is about the emissions of wood stoves or carbon fibers – which are not always that harmless – the development of a new material often is followed by the realization that neither its toxicological effects nor its disposal have been clarified sufficiently. This is exactly what Mülhopt is working on with her group and her collaborators from science and industry. For her, this is the perfect working environment which she finds simultaneously meaningful – even more so since her methods contribute to the reduction of animal testing.

The engineer embraces knowledge transfer and considers it a task of concern to society as a whole. She is therefore committed to the support of junior scientists and is a member of women's networks such as KIT's CIW-Ingenieurinnen-Netzwerk (network of female chemical engineers) in the Department of Chemical and Process Engineering and the WiKIT network for female scientists at KIT. ■

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Produkte entwickeln und gleichzeitig forschen – geht das? Natürlich!

Dr. Sonja Mülhopt arbeitet an Technologien zur Bewertung von Luftschadstoffen

Die Chemieingenieurin Dr. Sonja Mülhopt ist das beste Beispiel dafür, dass auch Zick-zack-Karrierewege ans Ziel führen können. Wegen ihrer Praxisnähe kam für sie mit Mitte 20 nur die Wirtschaft infrage. Gelandet und geblieben ist sie aber am KIT. Als Leiterin der Arbeitsgruppe Partikelcharakterisierung und Exposition am Institut für Technische Chemie (ITC) des KIT arbeitet sie an Systemen zur Beurteilung von Luftschadstoffen.

Alles begann mit ihrer Diplomarbeit in Kooperation mit dem heutigen Institut für Biologische und Chemische Systeme – Biologische Informationsprozessierung (IBCS-BIP) des KIT. Mülhopt arbeitete an einer Methode, um Partikel aus Abgasen auf menschliche Lungenzellen zu bringen und anschließend beobachten zu können, wie diese darauf reagieren. Bisher wurden Zellkulturen den Pulverproben dafür in einer Flüssigkeit ausgesetzt – ein Vorgehen, das nicht dem natürlichen Atemvorgang entspricht. Ein anderes Verfahren musste her.

Aus Mülhopts Diplomarbeit sind seitdem eine Arbeitsgruppe und ein ganzes Arbeitsfeld geworden. Mit ihrem Team hat sie eine Messzelle entwickelt, in der Lungenzellen Schadstoffen annähernd so ausgesetzt werden, wie dies beim Einatmen in der Lunge natürlicherweise der Fall wäre. Auch die Schadstoffdosis lässt sich live in diesem Testsystem einstellen und messen. Wenn aus dem inzwischen dritten Patent ein Produkt entstanden ist, wird es möglich sein, auch die Schädigungen der Zellen direkt während der Exposition zu messen.

Von Anfang an kooperierte Sonja Mülhopt mit der Firma VITROCELL® Systems GmbH. „Das erste Produkt zu entwickeln, hat mir schon damals unwahrscheinlich Spaß gemacht", erinnert sie sich. Der Rest war ein Selbstläufer. „Es kam der Hype um Nanopartikel, wir hatten Sensorik, die in der Lage war, Nanopartikel zu messen, und die Technologie, um toxikologische Untersuchungen durchzuführen", erinnert sie sich. Weitere große EU-Projekte folgten.

Ob es nun Carbonfasern oder andere innovative Stoffe sind – nicht selten folgt der Entwicklung eines neuen Materials die Erkenntnis, dass weder die toxikologische Wirkung noch die Entsorgung ausreichend klar sind. Und auch die Schädlichkeit von bekannten Emissionsquellen, wie der Rauch von Holzöfen, ist noch längst nicht vollständig verstanden. Genau daran arbeitet die Forscherin mit ihrer Gruppe und ihren Kooperationspartnern aus Wissenschaft und Industrie. Für sie ist es das perfekte Arbeitsumfeld. ■