MAX PLANCK INSTITUTE
FOR SUSTAINABLE MATERIALS

Press Release

26 June 2025

Advancing implants: Dr. Tim Schwarz receives Otto Hahn Medal

The Max Planck Society (MPG) has awarded Dr. Tim M. Schwarz, project group leader at the Max Planck Institute for Sustainable Materials (MPI-SusMat) in Düsseldorf, the Otto Hahn Medal. The €7,500 prize recognises outstanding scientific achievements in doctoral research. The award ceremony took place on 25 June 2025 during the annual general meeting of the MPG in Magdeburg.

Tim M. Schwarz's doctoral research focused on advancing atom probe tomography (APT), which is a microscopy method that enables the analysis of materials down to the atomic level, revealing the relationship between a material's internal structure and its properties. Initially developed for the investigation of metals, Schwarz successfully extended the technique to study frozen liquids. This breakthrough opens new possibilities, such as analysing dissolved organic materials in their natural environment.

In the second part of his dissertation, Schwarz focused on examining solid–liquid interfaces. "What happens at the surface between an electrolyte and the underlying material? Most critical processes, namely the degradation of materials leading to failure of function and performance, happen at this interface. Especially in the case of an implant when it comes into contact with blood or other bodily fluids?" he asks. He is particularly interested in magnesium implants, which are bioresorbable, thus being able to dissolve in the body and do not require surgical removal, unlike those made of titanium or steel. "Currently, magnesium alloys are not widely used for implants because they corrode quickly and unpredictably. It's extreme challenging to obtain composition and microstructure of these interfaces in operando conditions. I have developed a new preparation technique and extended the possibilities of atom probe tomography, to study the liquid-solid interface between the material and surrounding liquids to understand how different compositions and electrolytes affect corrosion processes."

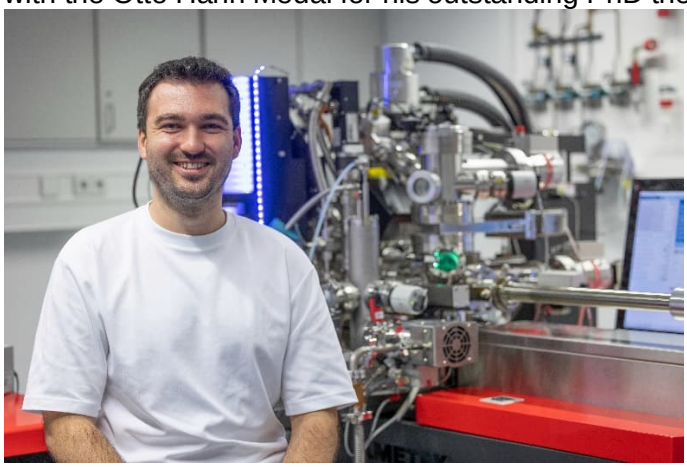
Initial results have revealed the formation of metastable phases at the interface. "We are now investigating how these phases influence the overall performance of the material," explains Tim M. Schwarz. These solid–liquid interfaces play a key role not only in implant degradation but also in the performance of batteries, catalysts, and infrastructure. The method Schwarz developed is also being used to study iron corrosion in humid environments in collaboration with the ETH Zurich, helping to better understand damage to bridges and buildings.

Dr. Tim Schwarz's work has already been recognised several times, most recently in 2024 with the Walter Benjamin Award from the German Research Foundation. For his advancements in using atom probe tomography to measure liquids, he received the Erwin Müller Award - the highest honour for young scientists in the field of atom probe tomography.

Schwarz studied materials science at the University of Stuttgart before joining MPI-SusMat in 2022 to complete his doctoral studies. In 2024, he received his PhD with the highest distinction (*summa cum laude*) from RWTH Aachen University. Since then, he is leading a project group at MPI-SusMat dedicated to investigating interfacial processes and reactions at near-atomic resolution.

Since 1978, the Max Planck Society has honoured outstanding doctoral theses with the Otto Hahn Medal. This year, 29 scientists were awarded. The award is one of the Max Planck Society's most prestigious distinctions for early-career scientists and is traditionally presented during the annual general meeting.

Prof. Claudia Felser, vice president of the Max Planck Society, awards Dr. Tim M. Schwarz with the Otto Hahn Medal for his outstanding PhD thesis. Copyright: David Aussenhofer, MPG


Dr. Tim M. Schwarz at the atom probe lab, where he analyses how the surface of magnesium implants corrodes. Copyright: Max-Planck-Institut für Nachhaltige Materialien GmbH

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