Prof. WALTER THEODOR CZARNETZKI

Institute for Sustainable Energy and Mobility (INEM), Germany

Short biography:

Prof. Dr.-Ing. Walter Theodor Czarnetzki is a professor of thermodynamics, heat transfer, and energy conversion at Esslingen University of Applied Sciences (Germany). He holds a Diploma in Engineering (Dipl.-Ing.) from Technische Universität Darmstadt (1991) and earned his Doctoral Degree (Dr.-Ing.) from the University of the Federal Armed Forces Hamburg in 1997.

Professional Career:

- **1992 – 1997** University of the Federal Armed Forces Hamburg (Germany) — Head of Laboratory
- **1997 – 2000** Henschel Defence Technology GmbH (Germany) — Head of Predevelopment Department
- **2000 – 2003** Sator Laser GmbH (Germany) — Head of Development Department
- **2003 – Present** Esslingen University of Applied Sciences (Germany) — Full Professor for Thermodynamics and Energy Conversion
- **2006 – Present** Institute for Sustainable Energy and Mobility (INEM), Germany — Founder and Managing Director

The teaching and research of Prof. Walter Theodor Czarnetzki focus on thermodynamics, heat transfer, energy conversion systems, and sustainable technologies. He has extensive experience in industrial R&D and has led numerous applied research projects at the interface of academia and industry.

Keynote title: Microwave-Plasmalysis: Opportunities and benefits in the context of energy storage.

Keynote abstract: In the context of climate change, the role of carbon dioxide (CO_2) as one of the main greenhouse gases is well known. Both the chemical and physical properties of CO_2 are analysed in order to better understand its influence on the climate and the challenges of reducing its concentration in the atmosphere. The presentation focuses on the direct splitting of CO_2. A particular focus is on plasmalysis as an innovative technology for CO_2 splitting.
Among the various plasmalysis processes, microwave plasmalysis (MW plasmalysis) is a promising method for efficiently breaking down CO_2 into its components. Therefore, the basic mechanisms of plasmalysis are explained, different methods are compared and, in particular, the advantages of MW plasmalysis are worked out.
The main aim of the research is to optimize the degree of conversion and the energy efficiency of CO_2 splitting using MW plasmalysis. In order to achieve this goal, various approaches to optimize this process are being investigated.
A central element of this research work is the analysis and optimization of the flow behavior within the reaction chamber, as this has a significant influence on the efficiency of CO_2 splitting. In this context, various simulation methods are presented that model and evaluate different aspects of the process. In addition, different concepts for targeted flow control are presented and their effects and potentials are shown.