

<i>Godzina</i>	<i>Prelegent</i>
13:00 – 12:05	dr hab. inż. Przemysław Data, prof. PŚ <i>Rozpoczęcie e-konferencji POB3: Materiały przyszłości. Wprowadzenie</i>
Ogniwa słoneczne i fotodiody perowskitowe Perovskite solar cells and photodiodes	
13:05 - 13:55	Prof. Rene Janssen* <i>Eindhoven University of Technology, Eindhoven (Netherlands)</i>
13:55 - 14:15	Dyskusja Q&A Zakończenie e-konferencji. <i>Moderator: Dr hab. inż. Przemysław Data, prof. PŚ</i>

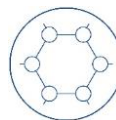
*Członek Międzynarodowej Rady Naukowej POB3 / Member of International Scientific Board POB3

Professor Rene Janssen



<https://orcid.org/0000-0002-1920-5124>

René Janssen leads the interdepartmental research group Molecular Materials and Nanosystems at Eindhoven University of Technology, which is part of the departments Chemical Engineering and Chemistry as well as Applied Physics. The research objective of the group is to investigate and develop molecules, macromolecules and



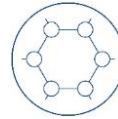
POB3: Materiały Przyszłości

(nano)structured materials with tailored physical properties. The interest in these functional molecular materials and nanosystems is driven by the scientific challenge to understand the underlying mechanisms of the physical phenomena in systems of reduced dimensionality, down to the molecular level. Future applications are in organic and polymer solar cells, electrochemical cells, transistors and diodes. Janssen has in particular obtained a thorough understanding of the subtle interactions of light and the chemical and electrical structures at the nanoscale. This has led to major improvements in the efficiency of polymer solar cells. The group now works on multi-junction molecular solar-to-electricity conversion devices, to further improve efficiencies. Another focus in Janssen's research is solar-to-fuel conversion using organic semiconductors in a process mimicking natural photosynthesis. To this aim new organic materials and electrocatalysts are being developed.

<https://www.tue.nl/en/research/researchers/rene-janssen/>



**Politechnika
Śląska**



POB3: Materiały Przyszłości

Perovskite solar cells and photodiodes

René Janssen

Eindhoven University of Technology, Eindhoven, The Netherlands

Dutch Institute for Fundamental Energy Research, Eindhoven, The Netherlands

The power conversion efficiencies of metal-halide perovskite solar cells are increasing rapidly and are closing the gap with crystalline silicon. For metal-halide perovskites, materials optimization involves the use of different combinations of metal, organic, and halide ions that control bandgap but also stability. This is particularly relevant for mixed-halide perovskites where phase separation occurs under illumination but that reverses in the dark. A main challenge for higher efficiencies is further reducing the energy loss between bandgap energy and open-circuit voltage. To establish the origin of remaining loss mechanisms, we use ultra-sensitive photocurrent spectroscopy and measure quasi-Fermi level splitting. These techniques help to identify the location and origin of defects. To really go beyond present efficiency limits, multi-junction solar cells are needed. In this respect, I will discuss progress and challenges in monolithic and stacked tandem and triple junction devices. Finally I will discuss the use of these devices as photodiodes, i.e. for detecting light, where understanding and reducing the reverse dark current is key to improving the specific detectivity.