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**TALLINNA TEHNIKAÜLIKOOL**

TALLINN UNIVERSITY OF TECHNOLOGY

# Energy Research at TUT

Jüri Krustok

# Energy research at TUT

- **FACULTY OF POWER ENGINEERING**
  - mostly Power electronics
- **Department of Thermal Engineering**
  - mostly biofuels, wind energy
- **Department of Material Science**
  - Solar cell research

# Power Engineering Faculty

## Four departments

- Electrical power engineering
- Electrical drives and power electronics
- Fundamentals of electrical engineering and electrical machines
- Mining

# Power Engineering Faculty: Main fields of investigations

- Optimising reserves in a power system and interconnected power systems with power market rules.
- Integration of alternative power sources and energy storage devices to the power network
- Research and development of small-scale power devices and equipment for distributed generation
- High power and high voltage converters for electrical drives and distribution networks
- Oil shale mining technologies

# Department of Material Science

## Solar cell research

- 4 professors
- 7 senior researchers
- 9 researchers
- 10 PhD students
- 10 master students

European Union Centre of Excellence  
in PV materials and devices.

# Why solar cells?



**In the future:**

- **we do not have anything to burn**
- **we do not even want to burn something because of our climate**
- **we still have enough solar energy to power the world**

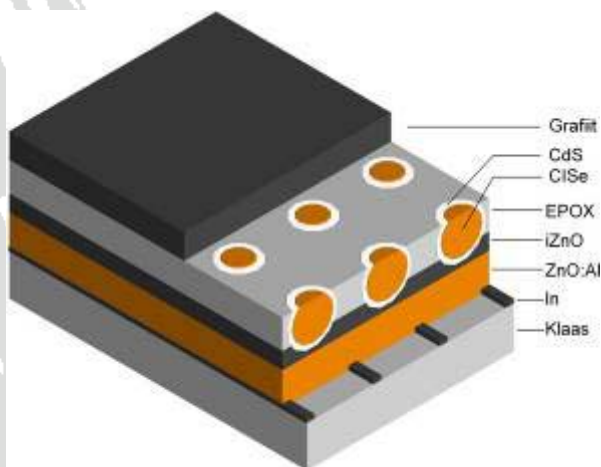
# Past and present EU RTD projects

- 2000 - 2004 *A challenging solar cell concept – the skilful intercalation of a nanostructured semiconductor by an extremely thin copper (indium) sulphide adsorber (HRPN-CT-2000-00141) – **ETA-SOLAR CELL**,*
- 2003 - 2005 *The European Polymer Solar Battery (ENK5-CT-2002-00687) – **EURO-PSB***
- 2003 - 2005 *Materials and Technologies for Photovoltaic Applications from Estonia (ENK6-CT-2002-80664 ) – **PV-EST***
- 2002 - 2004 *Co-ordination of NAS and European Union RTD Programmes on Photovoltaic Solar Energy (NNE5-2002-00046) - **PV-NAS-NET***

# Past and present EU RTD projects

- 2004 - 2007 *Optical and structural analysis of single crystals and thin films of  $\text{CuIn}_3\text{Se}_5$ ,  $\text{CuGa}_3\text{Se}_5$ ,  $\text{CuIn}_4\text{Se}_6$ ,  $\text{CuIn}_5\text{Se}_8$ ,  $\text{CuGa}_5\text{Se}_8$  for photovoltaic applications, **INTAS project** 03-51-6314*
- 2003 - 2005 *European Collaboration for identification of PV research and market opportunities, socio-economic studies, performance assessment and dissemination of PV thermal technology, **PV-Catapult***
- 2004-2007** *Science and Technology of Copper-indium Chalcogenites and Organic Conductive Polymers Based PV Solar Cells, **INTAS project***
- 2006 - 2010** *A science base on photovoltaic performance for increased market transparency and customer confidence, **Performance***

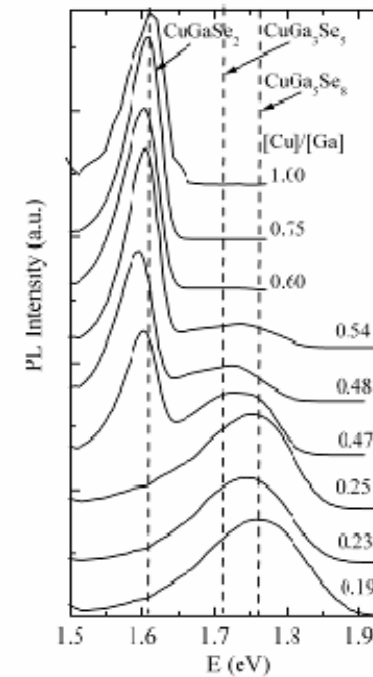
# Solar cell research



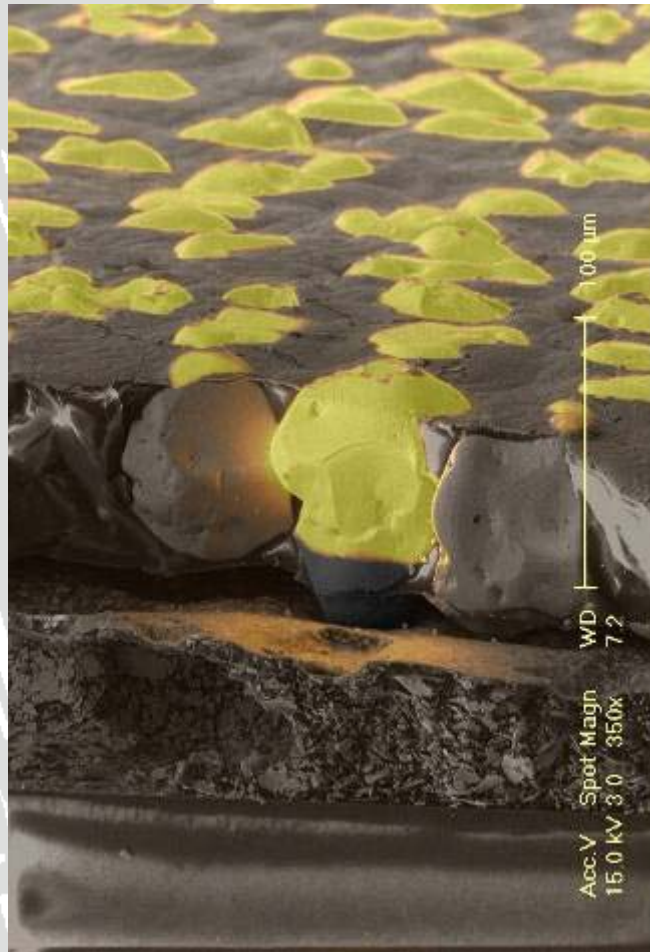
- **Material science- new cheaper materials**
- **Solar cell engineering and research- new construction of solar cells**
- **Outdoor testing of solar modules- northeast testpoint in Europe**

# New materials for solar cells

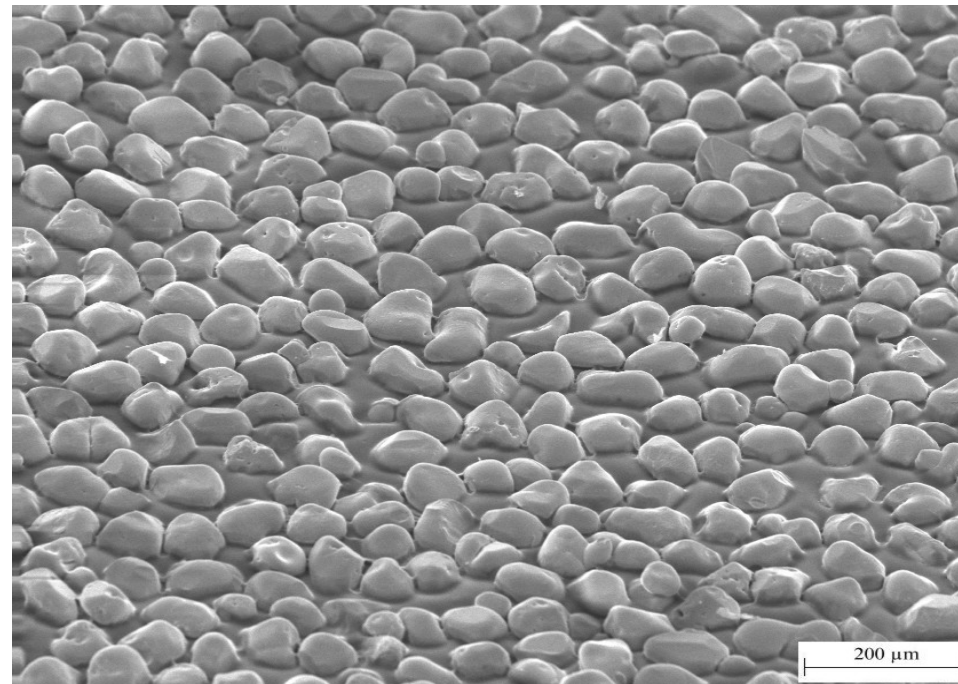
- $\text{CuInSe}_2$ ,  $\text{CdTe}$ ,  $\text{CuIn}_5\text{Se}_8$ ,  $\text{Cu}_2\text{ZnSnS}_4$  etc.



# Our new “monograin” technology



EBIC picture



SEM picture

# Outdoor testing of PV panels

Metal frames for mounting of up to 32 m<sup>2</sup> of modules on the roof of our department.



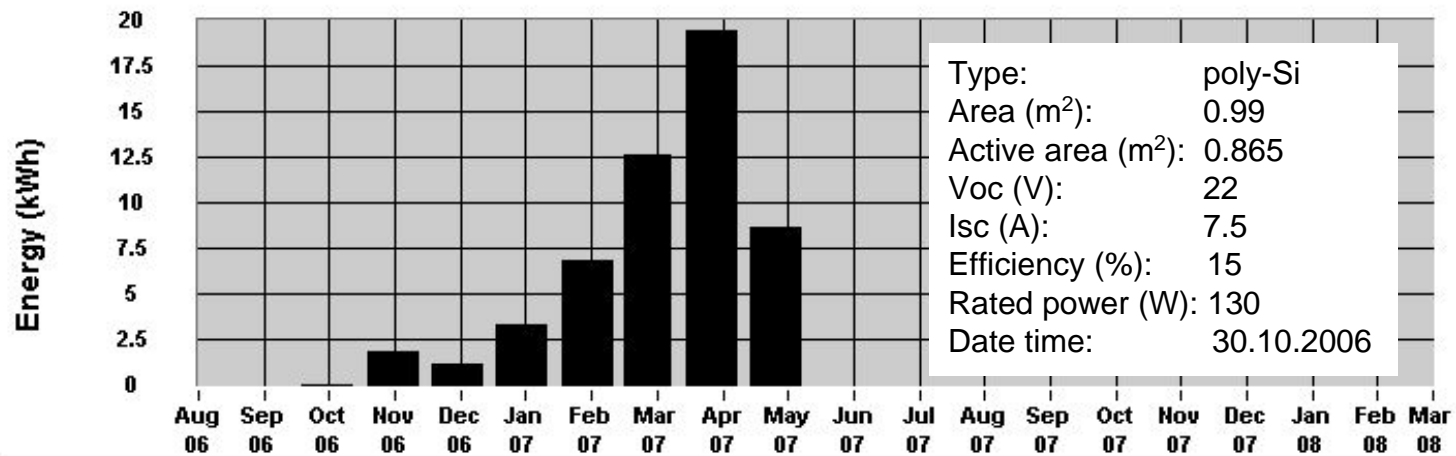
# Preliminary results

Currently 5 different PV panels are under testing.

Measured data are:

IV-curves

module temperature, solar radiation, weather parameters.



# Cooperation with JRC



EU commissioner of science  
and research  
**Janez Potočnik** visiting our lab.

- PERFORMANCE project - one member is also JRC.
- Long term collaboration with IES in Ispra.
- Future collaboration in the field of photovoltaics.

# Contact information

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*Thank you!*