

Institute for Nuclear Research



Established in 1954 by Prof. Sándor SZALAY.

Hungarian acronym of the Institute – ‘ATOMKI’



Primary activity of the Institute – both experimental and theoretical research in nuclear physics, material science and related fields

Today – the activity focuses on both fundamental and applied research: basic nuclear, atomic, particle and solid-state physics, applying physics in other fields e.g. surface science, earth sciences and environmental research.



Institute for Nuclear Research

- Number of researchers 100, total number of staff around 200
- PhD students connected to the educational program of University of Debrecen (UD)



Institute for Nuclear Research

Main facilities:

a cyclotron (MGC-20 type) and a 2 MeV Tandetron, an ECR ion source, spectrometers (XPS, SNMS), electron microscopes (SEM, FIB-SEM), scanning probe microscope (SPM)

- Basic research
 - Atomic physics
 - Nuclear physics
 - Nuclear astrophysics
 - Surface Science
- Applied research
 - Ion Beam Analysis
(various application areas)
- Innovation
 - P-beam writing
(e.g. microfluidics for medical applications)
- Education
 - MSc, PhD, outreach

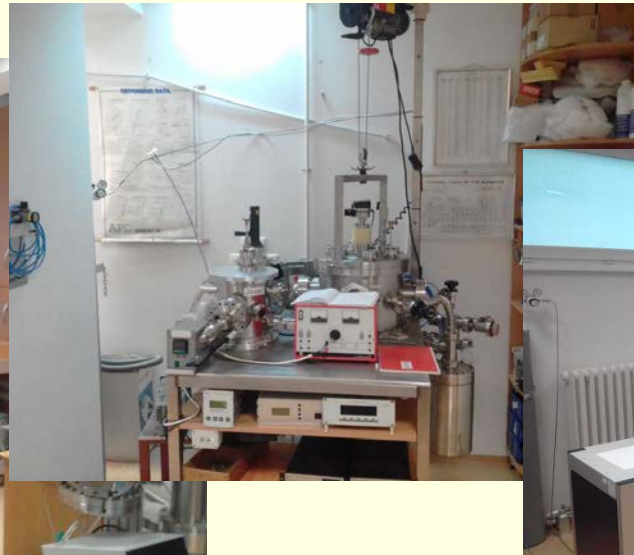


Electron
Cyclotron
Resonance
(ECR)
laboratory

A virtual walk in some labs can be done at the following link:
<https://virtual.atomki.hu/>

Laboratory of Materials Science

- Laboratory established in 2012.
- Two magnetron sputtering systems and atomic layer deposition system (ALD), possibility for depth profile analysis by sputtering method, chemical analysis by electron spectroscopy (XPS) & X-Ray diffraction, electron microscopy (TEM, FIB-SEM).



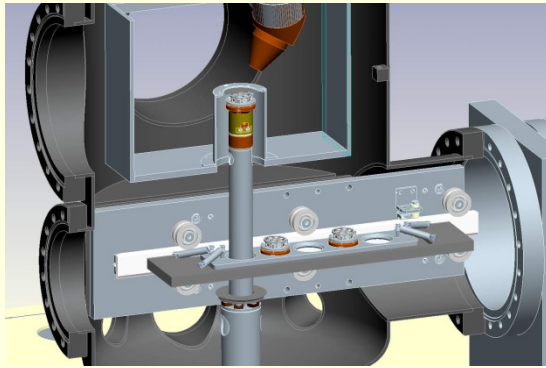
Role in BLACKSENS project

- performing SNMS depth profiling of the samples
- morphological, cross-sectional and structural analysis

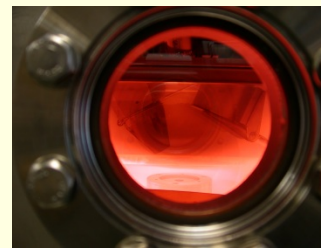
The goals are

- determination of relationship between observed sample structure and sample preparation procedures
- to give the feedback how to modify and improve the sample preparation procedures
- to provide output (studies) for colleagues to improve deposition procedures

➤ Secondary Neutral Mass Spectrometer (SNMS)



- depth profile analysis
- quantitative composition analysis
- analyzed sample area:
 $\text{Ø}1 \div 3 \text{ mm}$ (max. 14 mm)
- sample heating/cooling:
100K – 900K



Ne

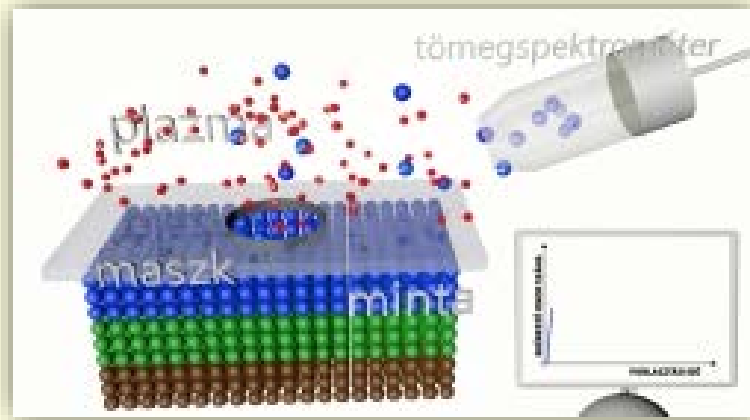


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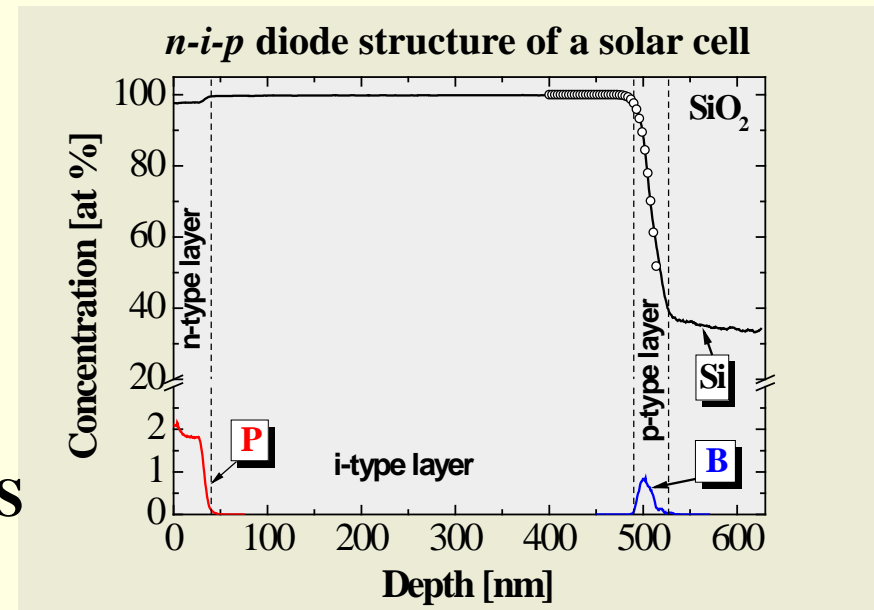
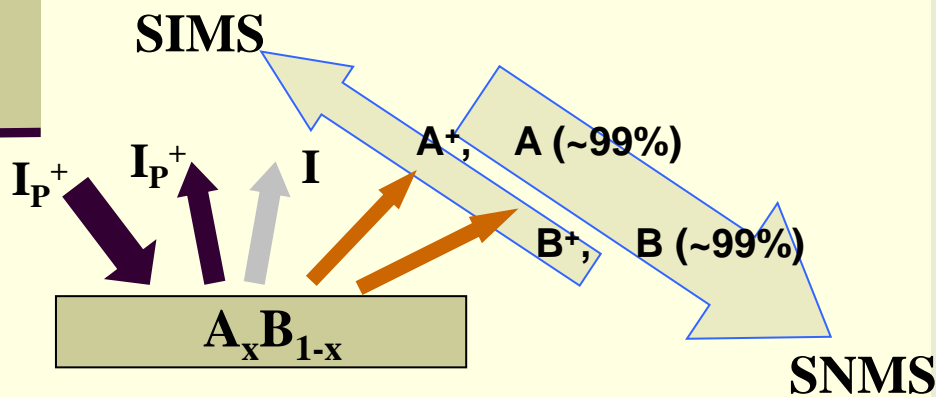


Kr

➤ Secondary Neutral Mass Spectrometer (SNMS)



- No matrix effect
- Typical sputtering rate – 0.2 nm/s at 250 eV ion energy
- Depth resolution $< \sim 1$ nm \rightarrow *if the sample has low surface roughness (!)*





Focused Ion Beam Scanning Electron Microscope (FIB-SEM)

- Surface morphological analysis
- Cross-sectional analysis
- Ion beam etching

X-Ray Diffractometer (XRD)

- for bulk and thin film samples
- detailed structural analysis
- XRD, GISAXS, GID

