POLYMER INSTITUTE SAS

POLYMER INSTITUTE SAS
Science is the future!

Department of Composite Materials

DCM

The Polymer laboratory established by Dr. Milan Lazar at the end of 1962 created the conditions for founding the **Polymer Institute** in 1967.

The Institute initiated the focused research in polymer chemistry as a part of the chemical research at the Slovak Academy of Sciences. Currently Polymer Institute SAS represents an important research and training center for basic and applied research in the contemporary topics of polymer chemistry. The Institute activities cover four areas: synthesis and characterization, composite polymeric materials, polymeric biomaterials and molecular simulation of polymers.

As a result of the PISAS accreditation for years 2012 − 2015, the international accreditation panel of experts evaluated institute with the highest rating A characterized as "The research is internationally leading within the European context. The institute has demonstrated important contributions to the field and is considered an international player in Europe. ".

4 Departments:

Department of Molecular Simulations of Polymers

Department for Biomaterials Research

Department of Synthesis and Characterization of Polymers

Department of Composite Materials
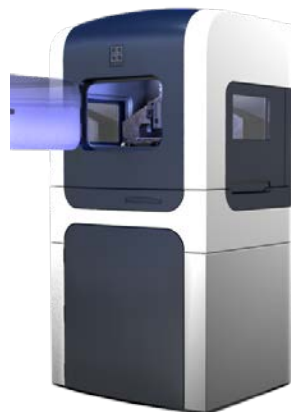
DCM

Department of Composite Materials

Head of DCM: Ing. Mária Omastová, DrSc.

13 research scientists, 2 PhD students,

2 technical assistants

**XPS K-Alpha
ThermoFisher Scientific**

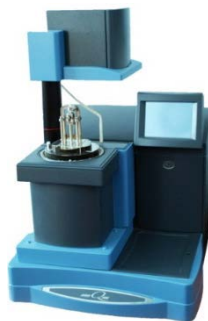**Nanoindentor HysitronTl-750**

**Dielectric spectrometer
Novocontrol**

**Rheometer AR2000
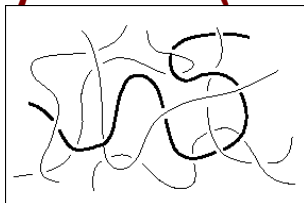TA Instruments**

**Contact Angle,
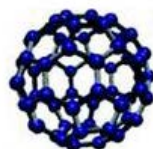Dataphysics OCA25**

**DMA Q800
TA Instruments**

**Brabender
Micro-compounder
Instron (tensile test)
Low temperature Plasma equipments,
RDF , DCSBD
Leica DVM6-digital optical microscope
Biologic SP-200 potentiostat**
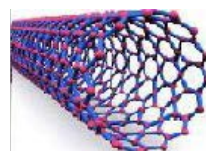
Polymer (nano)composites

Polymer + (nano)particles (0D, 1D, 2D, 3D)
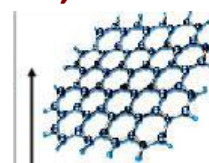
fulerén,
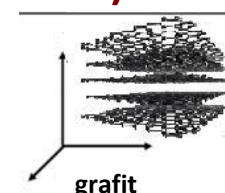kvantové bodky
(perovskit, uhlík)
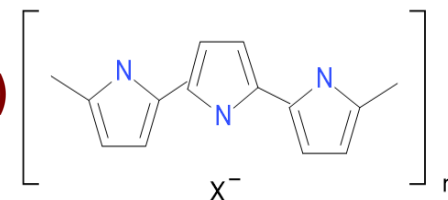
uhlíkové nanotrubičky

MXén,
grafén, MoS_2

grafit
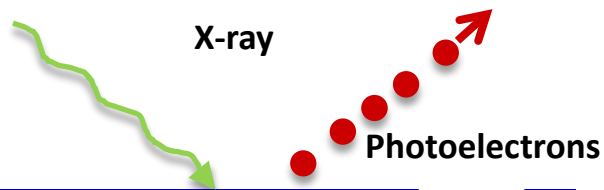
hybrids with conducting polymers (popypyrrole)

surface and interface engineering of multicomponent systems – nanoparticles modification, polymer (nano)composites preparation, materials characterization

applications: solar cells
electromagnetic shielding
sensors, actuators, batteries,
engineering plastics
etc.

Binding Energy = Photon Energy – Kinetic Energy
Calculated   Known   Measured

X-ray

Photoelectrons

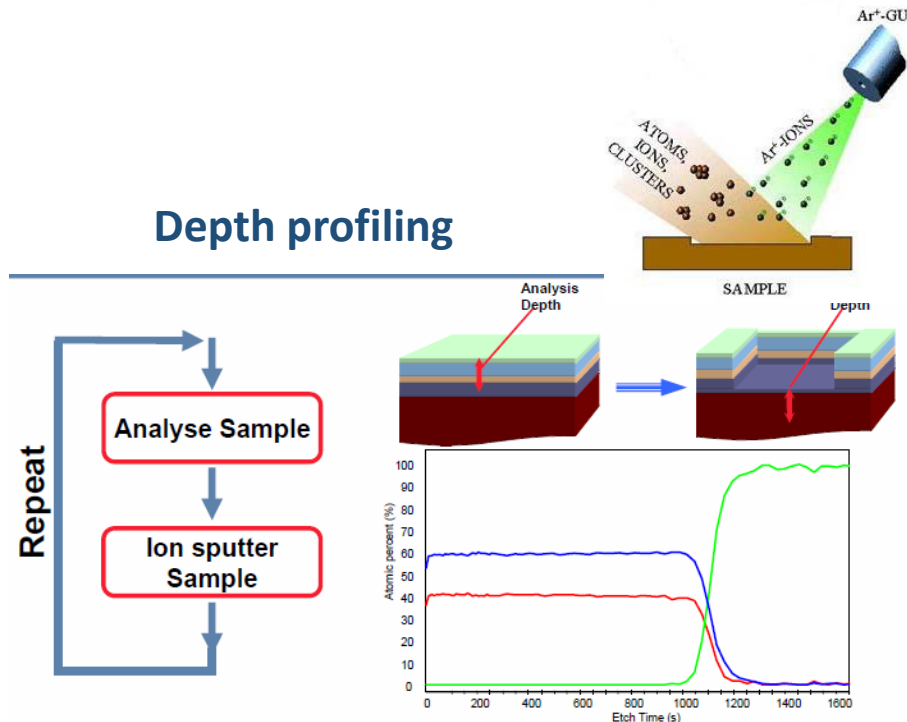**Surface**

Analysis depth 1 – 10 nm

$d = 3\lambda\cos\theta = 1 - 10$ nm

Depth profiling

Ar+-GUN

ATOMS, IONS, CLUSTERS

Ar+-IONS

SAMPLE

Analysis Depth

Depth

Repeat

Analyse Sample

Ion sputter Sample

Angle Resolved XPS

e⁻

40° e⁻

Spectra from normal emission in blue

Spectra from tilted emission in green

Si 2p

SiO$_2$

108   104   100   96
Binding energy / eV

Increasing depth

C

Zr

O

SiO$_2$

Si^0

Relative Depth Plot for ZrO$_2$ film sample
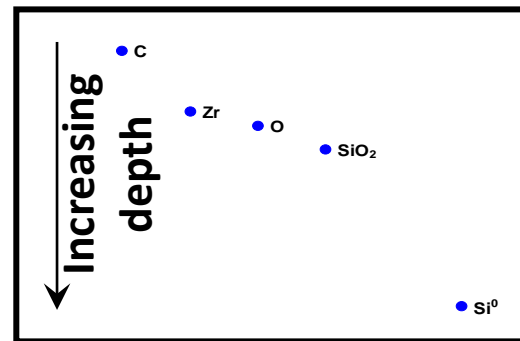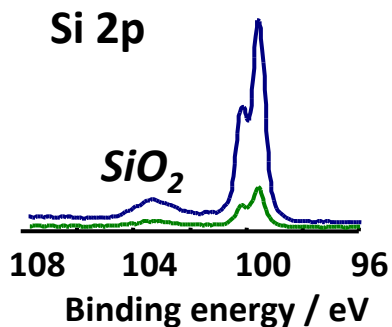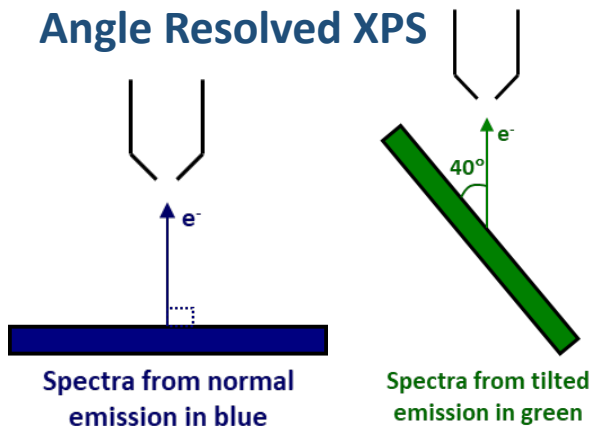
Nominal stack structure

C

ZrO$_2$

SiO$_2$

Si

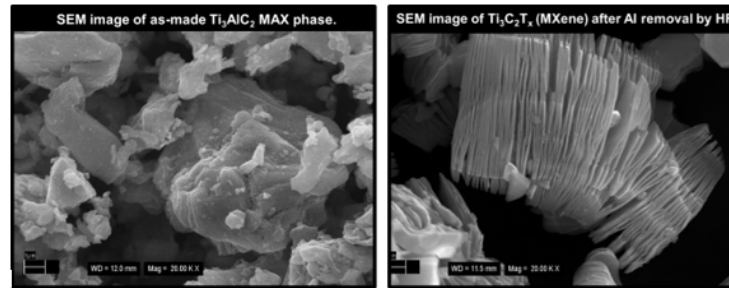**WP3 (PI SAS)– Preparation of 2D materials, measurement of mechanical properties, XPS**

- **Preparation of 2D nanosheets of exfoliated 2D nanomaterials (MXene, graphene).**

SEM image of as-made Ti$_3$AlC$_2$ MAX phase.

SEM image of Ti$_3$C$_2$T$_x$ (MXene) after Al removal by HF.

- surface and interface properties of prepared BM film by XPS.

- nanomechanical properties and surface morphology of prepared heterostructured BM films will be studied by Nanoindentation.