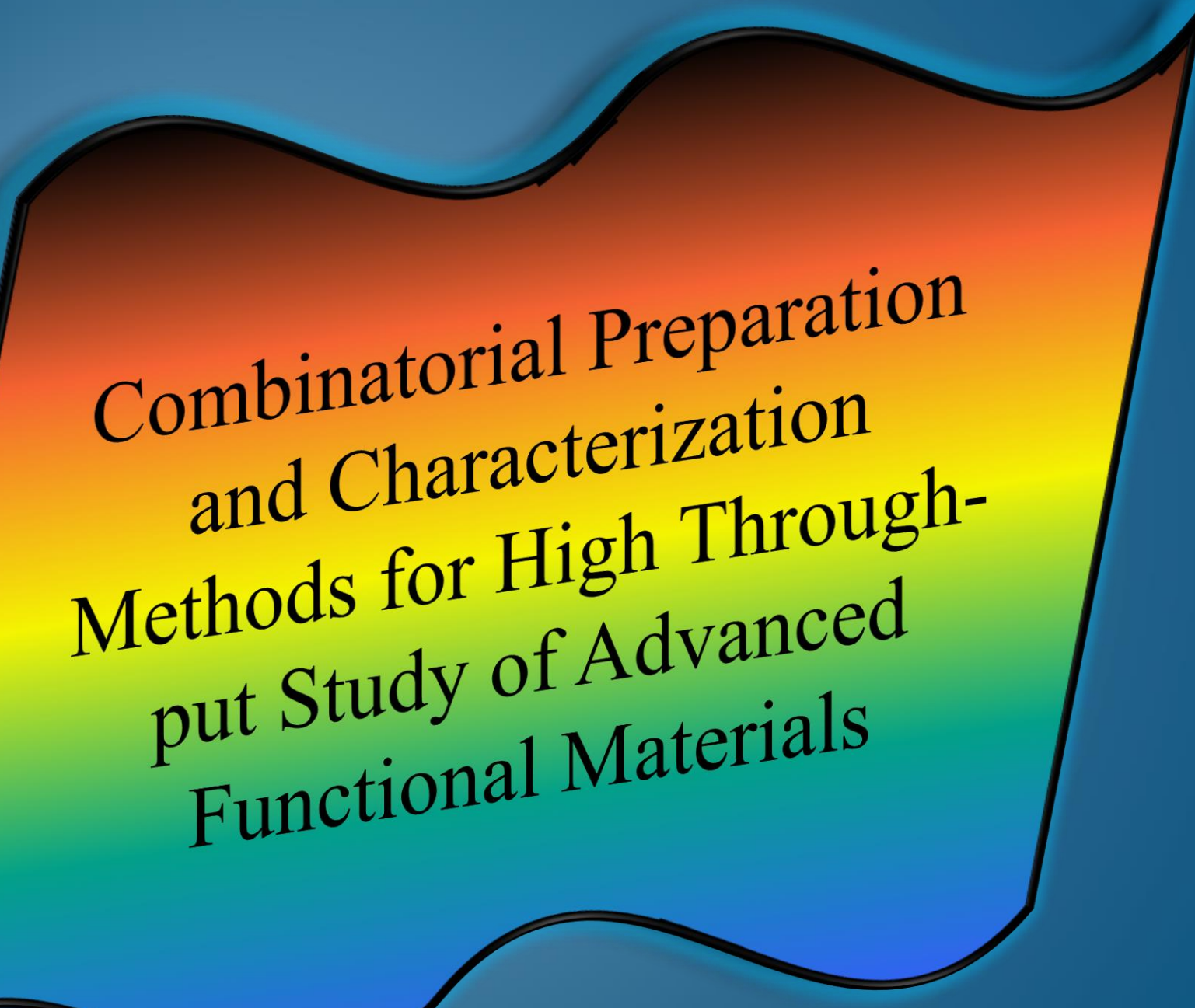


BY Phd Student

Noor Taha Ismaeel

supervisor
supervisor

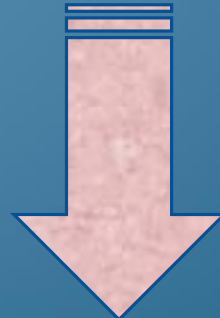
Prof. Dr. **FRIED MIKLOS**



Combinatorial Preparation
and Characterization
Methods for High Through-
put Study of Advanced
Functional Materials

Aim of the Research

To understand and optimize the electrochromic behavior of mixed metal oxides deposited by reactive sputtering.



Research Work

We will prepare thin films of mixed Titanium, Tin Oxide and WO_3 - MoO_3 mixed layers on glass by reactive DC magnetron sputtering. The deposited $A_xB_{1-x}O_n$ type films will be characterized by a variety of methods.

Research methods:

Preparation methods

Pulsed mode reactive DC magnetron , biased RF sputtering systems and Laser ablation deposition system

Characterization methods

Spectroscopic Ellipsometry, Rutherford Backscattering Spectrometry, Transmission Electron Microscopy, Scanning Electron Microscopy and Atomic Force Microscopy

**Prof.
Dr.M.
Fried et
al;**

**Combinatorial
Investigation of
WO₃-MoO₃
Mixed Layers by**

**Effective Medium Approximation
Proceedings of [Óbudai Egyetem
(2020) 44 p. pp. 3-10. ISBN:
9789634492368, REALG.] has been
developed.**

**Spectroscopic
Ellipsometry
to assess**

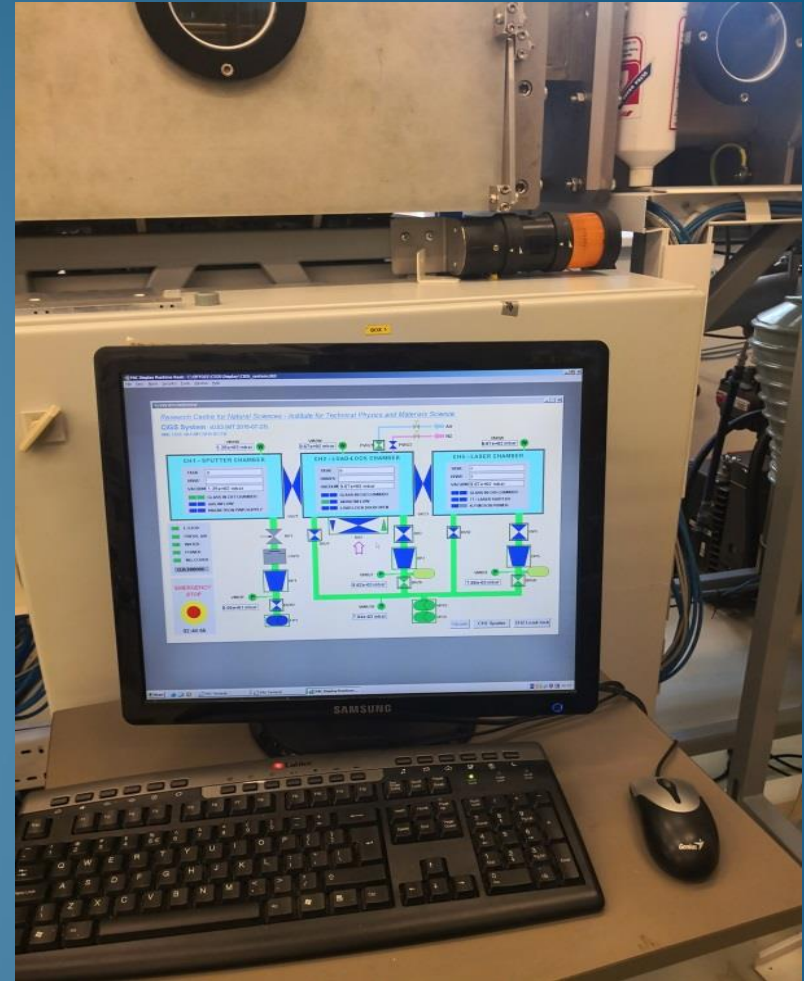



Figure (1) shows the DC magnetron sputtering systems, and its parameters.



Figure (2) the chamber for DC magnetron sputtering device after air vacuumed. Blue light is from the Ar-O₂ plasma.

DC magnetron sputtering device



*Which it is considered
one of the important
preparation devices in the
Institute of Technical
Physics and Materials
Science, Centre for
Energy Research (MFA).*

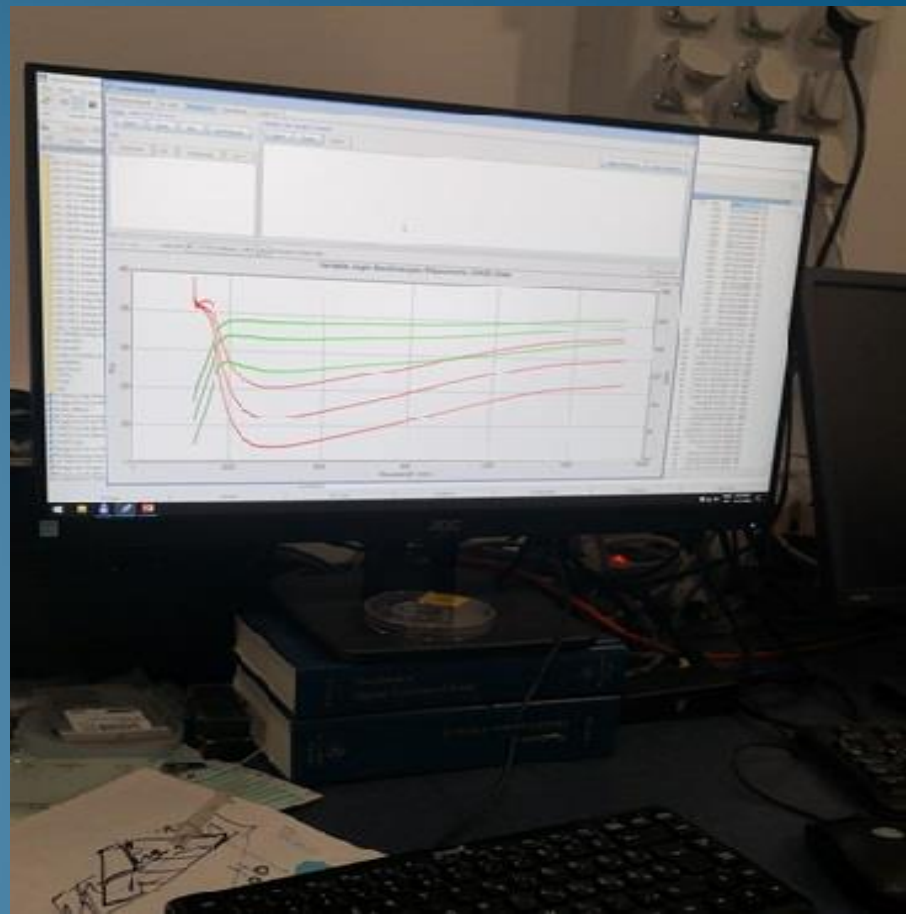
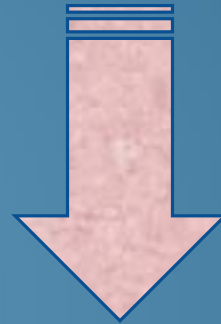


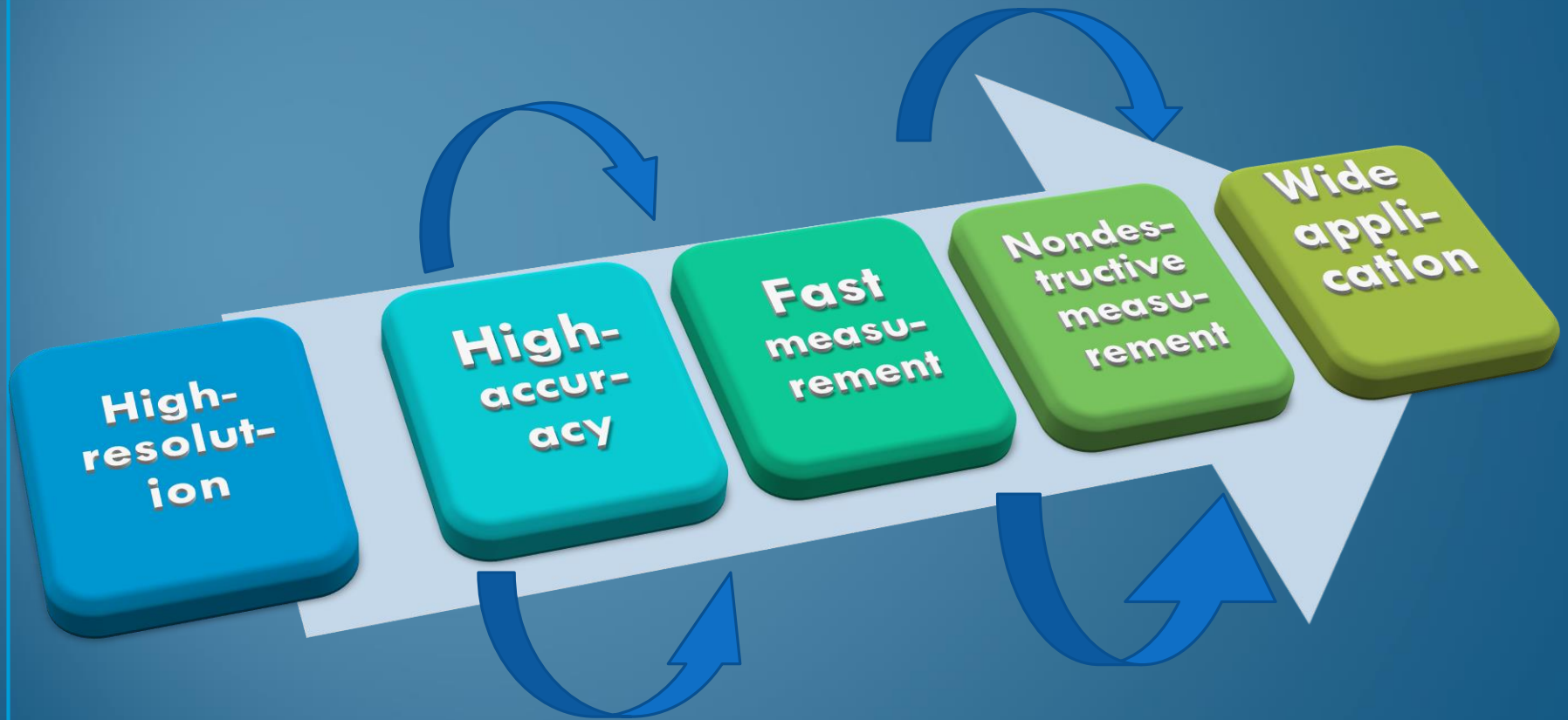
Figure (3) Spectroscopic Ellipsometry devices, a) Woollam M-2000DI, b) imaging ellipsometer (Source: <http://www.ellipsometry.hu/#Equipment>) and the data analysis parameters for the device.

**The Woollam M-2000DI
rotating compensator
spectroscopic ellipsometer**



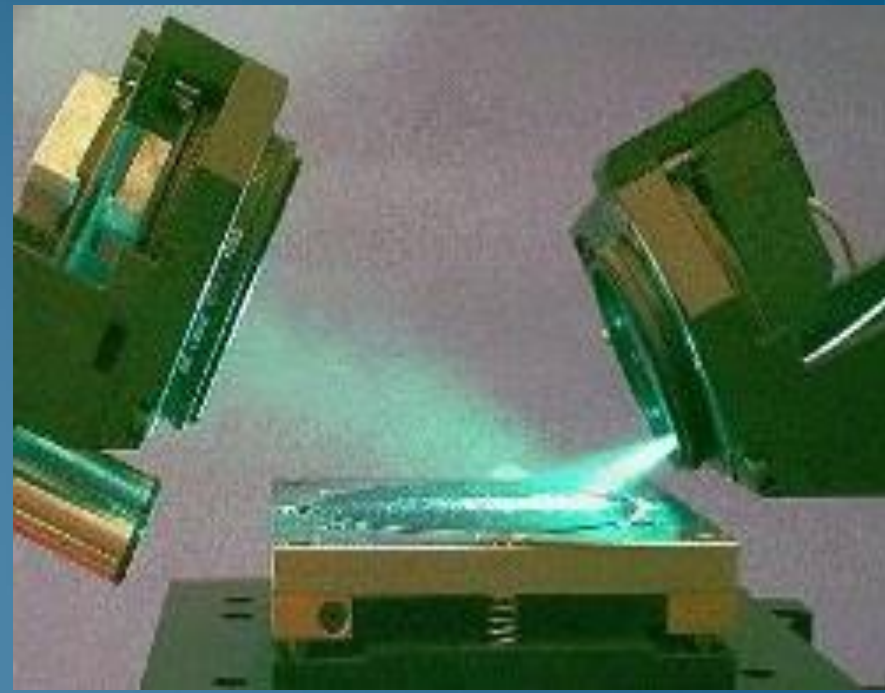
**Wavelength range of 191-1690 nm
(photon energies of 0.7-6.5 eV),
Automatic scan with a micro-focused
(ca. 0.2 mm) spot. Angle of incidence: 45-
75 degree. Measurement time 1 sec per
spot.**

The Advantages of this device





(a)



(b)

Figure (4), (a) Spectroscopic Ellipsometry for 50x50 cm samples device, (b) The procedure work

Transmission Electron Microscopy

(TEMs) is direct measurement technique constitute the most efficient tools for the characterization of materials over spatial ranges from the atomic scale, through the ever-growing 'nano' regime (from < 1 nm to 100 nm)



*Plans for the
future:*

We (with Dr Zoltán Lábadi and Prof Dr Miklós Fried) have prepared the first combinatorial samples: WO₃-MoO₃ mixed layers on glass- (for electrochromic measurements) and Si-substrates (for spectroscopic ellipsometry and RBS control measurements), see Figure (5), The measurements have been evaluated in 4rth of January.



Figure (5) WO₃-MoO₃ combinatorial mixed layers on glass- and Si-substrates on top of a 30x30 cm glass sheet. The pale colored bands show the changing thicknesses and compositions.

Teaching activity:

- 1-** I was being in the teaching course of Prof. DR. George Kaptay (Miskolc University) about "Art-of-doing-science" in English languages.
- 2-** I attended at the lecture of Prof. Dr. Laszlo S. Toth presented on December 13.
- 3-** I attended home defense of the PhD work of Larbi Eddaif, heled in the Research Centre for Natural Science on Tuesday, November 2nd.
- 4-** I attended the welcome event in Obuda University in 94-96, building. Date: 2021.10.08.

Courses Completed

**Optical
characterization
of thin layers
Prof.Dr.(Péter
Petrik).**

**(TEM) for
structural
investigations of
different materials
Dr.(Katalin
Balázs).**



Thanks for your attention