Networking and Brokerage Event

Horizon Europe

MSCA Staff Exchanges Call 2024

Material Designing for Quantum Technology

17 October 2024

Dr. Pallavi Kushwaha
Principal Scientist
Bharatiya Nirdeshak Dravya (Indian Reference Material) Division
CSIR-National Physical Laboratory, New Delhi

Dr. Pallavi Kushwaha

Principal Scientist

Bharatiya Nirdeshak Dravya (Indian Reference Material) Division

CSIR-National Physical Laboratory, New Delhi

S No	Name	Email-id	Contact
1	Dr S P Singh	singhsp@nplindia.org	+91-9811922607
2	Dr Pallavi Kushwaha	Pallavi.Kushwaha@nplindia.org	+91-9004184756
3	Dr Sandeep Singh	singht@nplindia.org	+91-9968424617

Broad Research Area: Single Crystal Growth of Quantum Materials (Oxides/ Intermetallic), Two-dimensional quantum materials (Conducting Oxides, Frustrated Magnetic Materials..) Multifunctional Materials, Superconducting Thin Films, Permanent Magnets, Nanomaterials for Energy Devices

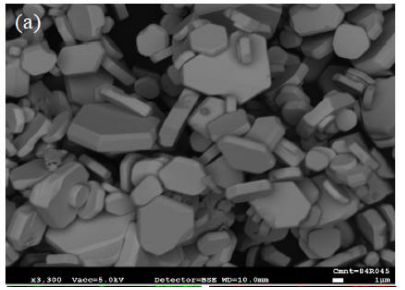
Material Designing for Quantum Technology

Single Crystal Growth Lab
Intermetallic and Oxide materials

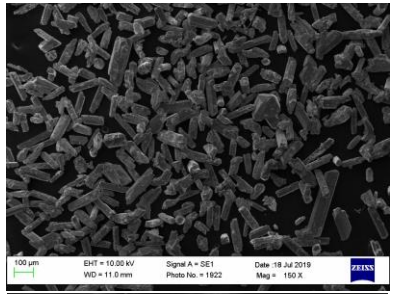
- Glove Box *(Revived)* → Mbraun- H_2O<1ppm and O_2<1ppm
- Modified Bridgeman Technique → Box Furnace: T~1400^{0}C
- Chemical Vapor Transport → Nabertherm: 3 Zone, T~1200^{0}C
- Flux Method → Self flux- water soluble
- Uninterrupted power supply → Crystal growth runs for couple of week
- Centrifuge → To remove metallic flux
- Glass blowing → Sealing of quartz under High vacuum, dual wall, conical shape etc.

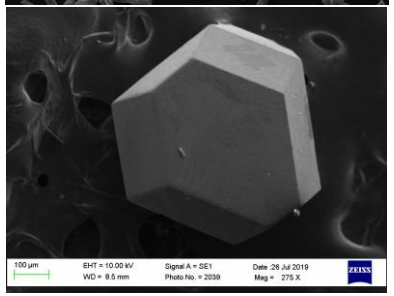
2D Oxides Materials

ABO_2



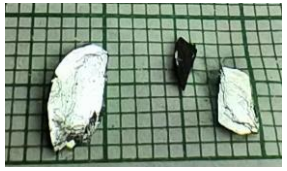
RuO_2

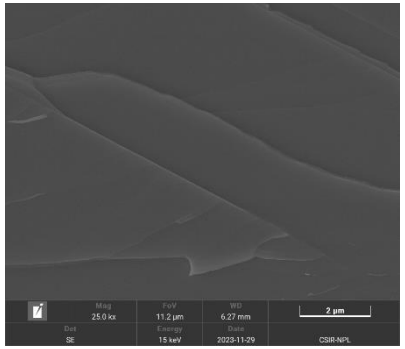


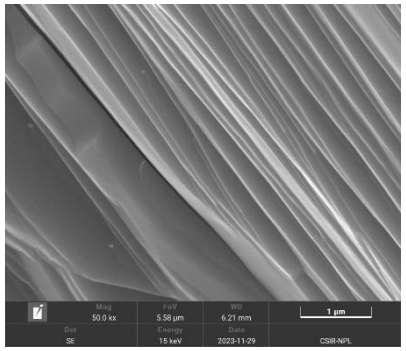


$BaCo_2(AsO_4)_2$

Intermetallics

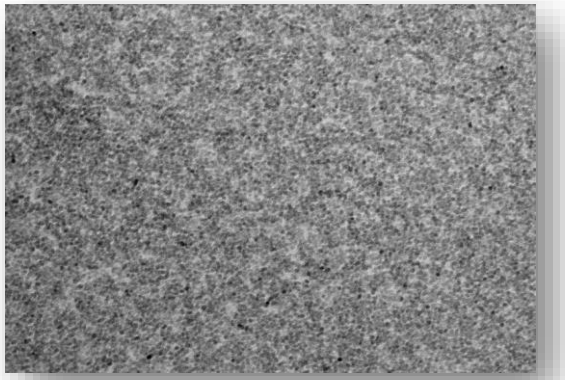




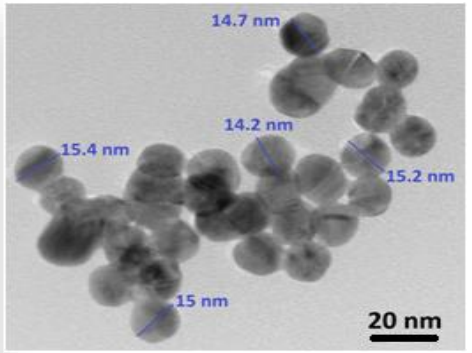


Material Designing for Quantum Technology

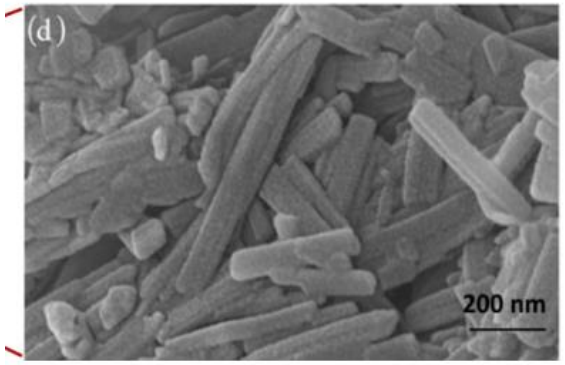
Nanomaterials



ZnO Nanoparticles : 4 to 6 nm



Gold Nanoparticles : 15 nm



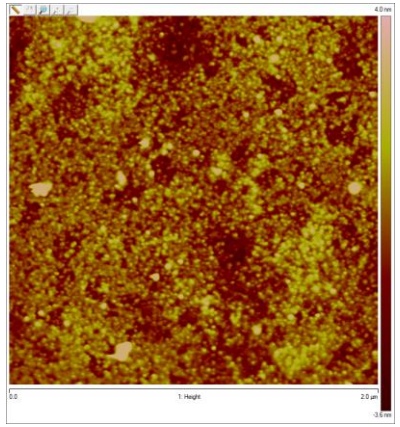
V_2O_5-rGO nanorods

Thin Film Preparation

Sputtering

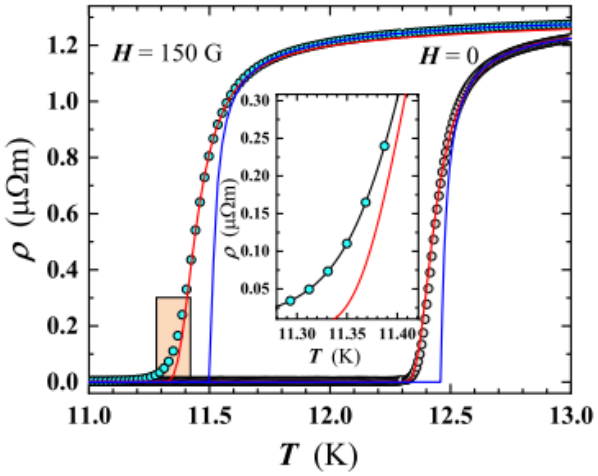
Ion Milling System

NbN Thin Films



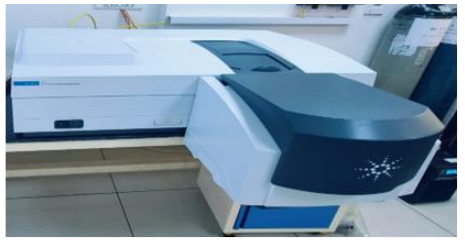
Characterization Techniques

- Rigaku MiniFlex XRD
- Magnetic Properties Measurement System
- Inhouse Resistivity Measurement System
- UV-VIS NIR Spectrophotometer
- FTIR
- SPM-RT (AFM/ MFM/ KPFM/EFM)



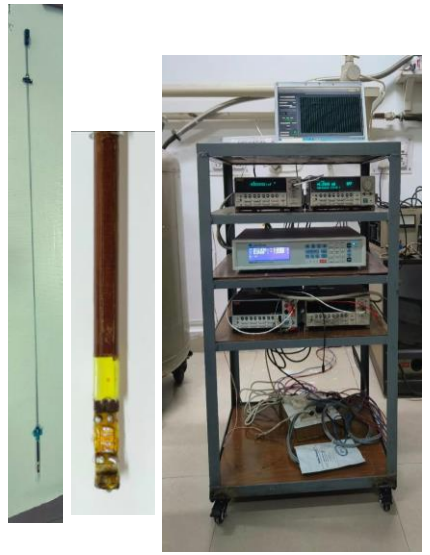
FTIR- Spectrophotometer

MPMS

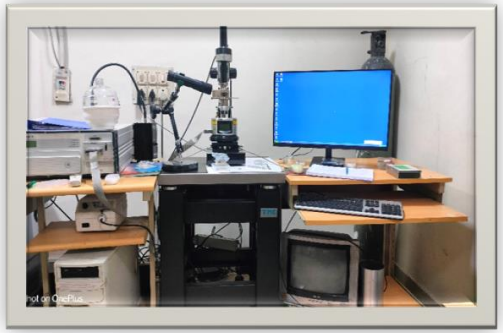


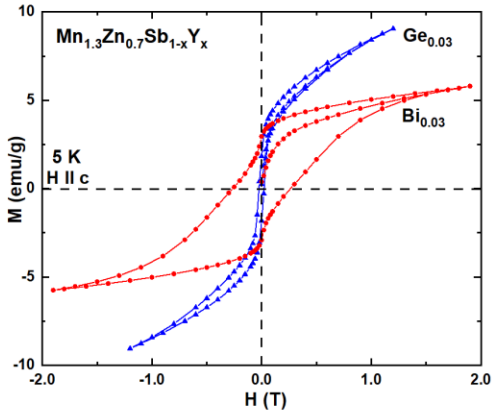
UV-VIS-NIR Spectrophotometer

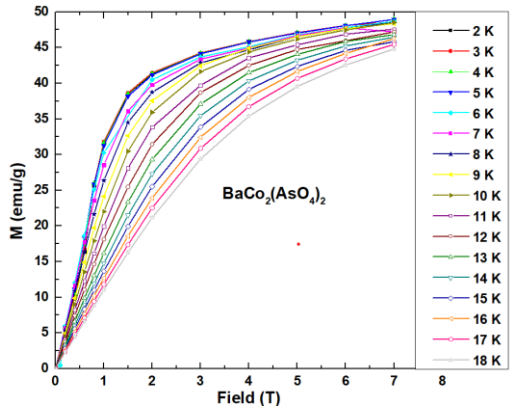
Electrical Transport MS



Atomic Force Microscope (AFM)

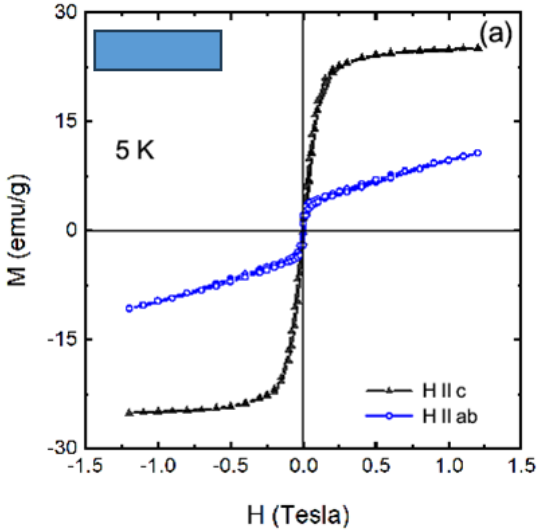


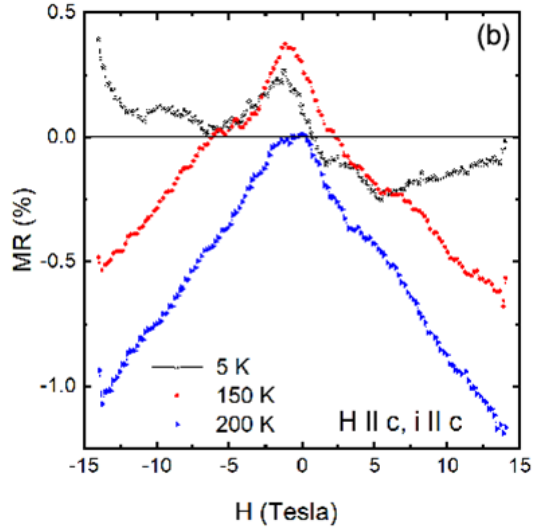


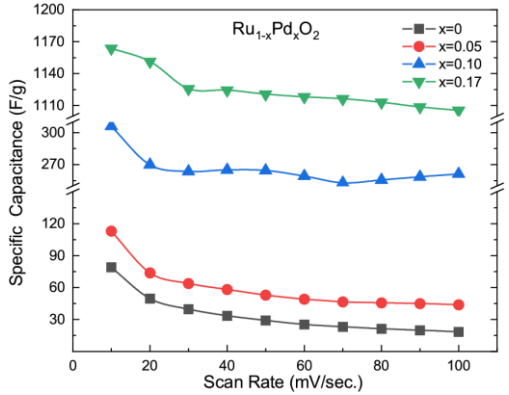


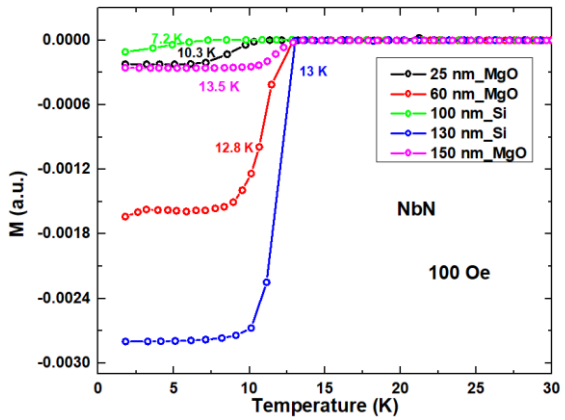
Materials shows

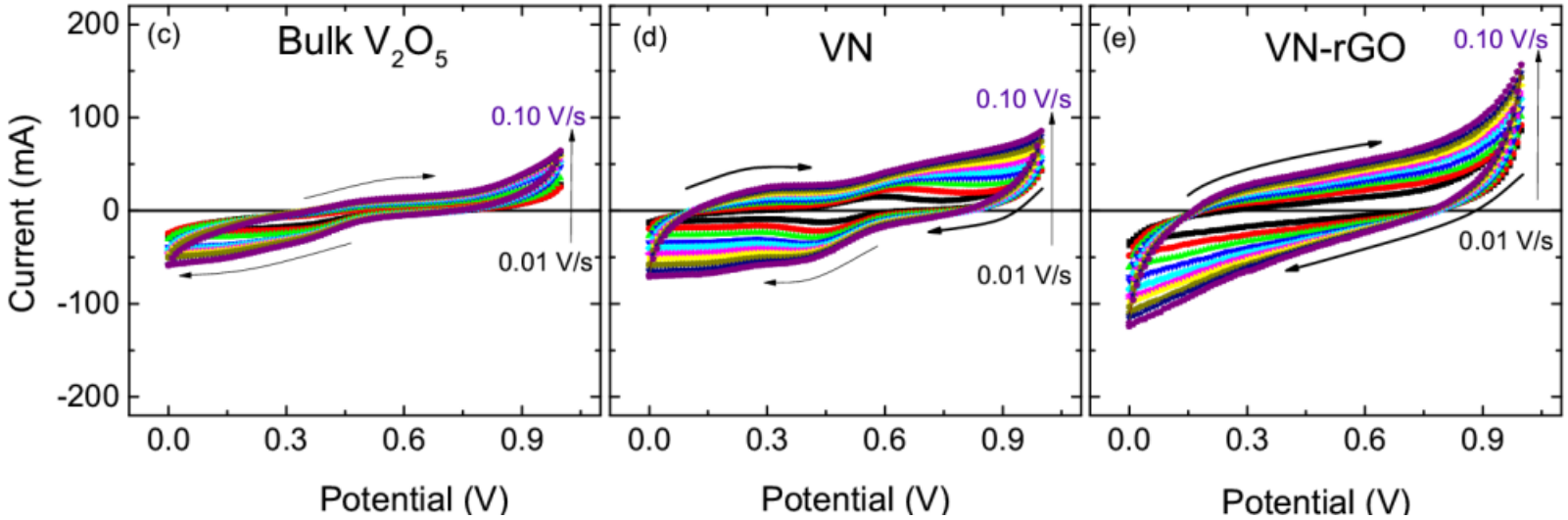
- Spin Valve Effect
- Magnetic Phase Coexistence
- Battery-Supercapacitor Hybrid Characteristics
- Skyrmion Characteristics
- MCE-MR-MS Tunability
- Thickness Controlled Superconductivity











Pallavi.Kushwaha@nplindia.org

Looking forward in the area for collaboration:

- New Materials Synthesis
- Structural Determination of new compounds
- Single Crystal X-ray diffraction
- Theoretical calculations
- Beam line experiments

Device fabrication

Quantum Technologies

LGWA Program

Institute:

MPI-CPfS, Dresden and Uni. Of Camerino, Italy

Institute for Collaboration

Dr. Uri Vool
Max Planck - Dresden, Germany

Prof. Andrea Perali
University of Camerino, Italy

Thank you

Pallavi.Kushwaha@nplindia.org