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I am **Dr. Paleth Muhammad Razi,** a PhD holder from Pondicherry central University, India. During my PhD period, I have worked on the threshold and bipolar resistive switching properties of amorphous barium titanate with special attention towards future neuromorphic memories. In PhD work, we report the threshold, bipolar and bipolar assisted ferroelectric resistive switching behavior of Barium Titanate thin film along with endurance and retention measurements by comparing with the existing literature. I am very happy to inform you that the part of the above work is presented at DAE-SSPS-2019 conference which was held at IIT jodhpur won the best poster award.

I compllteted my masters (MSc) in Aligarh muslim university, a well known central univetsity across the India. I comleted my graduation in physics (BSc) and education (BEd) from Calicut university. I Worked as a Resaerch associate / Research staff in Department of Metallurgical and Materials Engineering, Indian Institute of Technology (IIT) Madras. As an output of my research carrier, I have 4 publications in my basket.

Experiences

1. Worked as a research associate - I (RA - I) at Metallurgical and Material Engineering Department**, Indian Institute of Technology Madras (IIT Madras),** India under the supervision of Dr. Satyesh Kumar Yadav (11/03/2021 to 31/12/2021).
2. Worked as a project assistant at the Department of Physics**, Calicut University**, Kerala, India under the supervision of Dr Muhammed Shahin Thayyil (01/09/2020 to 28/02/2021)

Expertise gained while working as a Research associate

Topic of research:

Ultrathin metal thin film (< 8 nm) for transparent/flexible optoelectronic devices

1. Hands-on experience on Semi-automatic DC sputtering system (ATS 500) for the ultra-thin film (< 10 nm) deposition while working as RA-1 at IIT madras.
2. Hands-on experience on Atomic force microscopy (Bruker Dimension icon) in ScanAsyst mode, Taping mode and contact mode.

Expertise gained while doing PhD

Topic of research:

Resistive, ferroelectric switching studies in **Barium titanate** (BaTiO3) thin films for memory applications

1. Hands-on experience in thin-film fabrication techniques such as DC/pulsed DC/RF sputtering system (Manual –APT Pune) and spin coating.
    a. The depositing material includes BaTiO3, SiO2, TiO2, Ag, Ti, Cu, Co, etc.
2. Hands-on experience on Atomic force microscopy (Bruker Multimode 8) in three different modes (Tapping mode, Contact mode for both imaging and electrical measurements (Conductive AFM) and ScanAsyst mode) and analysis. (I was one of the AFM operators).
3. Hands-on experience of electrical (IV, CV, CF, Resistivity measurement etc) and Magnetic measurements
4. Hands-on experience on low-temperature measurements (Associated with IV, CV and MR) using cryostat up to 10 kelvin.
5. Homemade C-V measurement set-up has been made using DC voltage source and LCR meter to measure capacitance vs voltage measurement.
6. As a part of my PhD, automation of the measurements has been done using LabVIEW programs which are designed and built by myself. (LabVIEW programs for I-V, C-F, C-V, Magnetoresistance, magnetocapacitance, temperature-dependent resistivity, Retention and endurance measurements for bipolar resistive switching measurements).
7. Expertise in the characterization of samples using SEM, AFM, XRD, Raman spectroscopy, XPS, UV-Visible-IR spectroscopy and electrical characterization includes I-V, C-F, C-V, Magnetoresistance, temperature-dependent resistivity, Retention and endurance measurements for Bipolar resistive switching measurements.

Computer Skills

- LabVIEW
- LaTex
- Origin lab
- Nanoscopeanalysis for AFM analysis

Research Interests

- Thin film and device fabrication.
- Resistive switching, Ferroelectric, Piezoelectric, Ferromagnetic, Spintronics and Multiferroic.
- Heterojunctions and composite materials.
- Physical vapour depositions like Sputtering, PLD and ALD.
- Perovskites, Organic and other functional materials.
- Electrical and Magnetic characterization.

- Electric field controlled magnetic switching or vice versa
- Magnetic thin films.

PhD. Overview

1. Fabrication of different resistive switching devices by using DC/Pulsed DC/RF sputtering systems.
2. **Fabrication and analysis of Threshold resistive switching devices** (Volatile) using amorphous Barium titanate (BTO) thin film in Ag, Ti, Cu, Co/am-BTO/Ag cross point geometries.
3. Understanding of threshold resistive switching property which is mediated by oxygen vacancies in light with **X-ray photon spectroscopy**.
4. **Fabrication and analysis of Bipolar resistive switching devices** (Non-volatile) amorphous Barium titanate (BTO) thin film in Ag/am-BTO/ITO and Ag/am-BTO/FTO dot point geometries
5. Analysis of bipolar assisted ferroelectric resistive switching in Ti/am-BTO/ITO dot point geometries.
6. Understanding of ferroelectric (behaviour) switching in Ag|am-BTO|Ag in a novel parallel electrode geometry by using a 100 µm thick copper wire as a mask.

Awards/Fellowships

- Basic Science Research fellowship award (BSR-JRF) for the period of 2015-2019.
- Best poster award in **DAE-Solid State Physics Symposium** held in **Indian Institute of Technology Jodhpur**, December 2019.

Publications

1. **P. Muhammed Razi**, R. B. Gangineni, "Bipolar resistive switching studies in amorphous barium titanate thin films in Ag/am-BTO/ITO capacitor structures", Materials Science and Engineering: B. https://doi.org/10.1016/j.mseb.2020.114852, **(Impact factor: 4.71)**
2. **P. Muhammed Razi**, R. B. Gangineni, "Compliance current and film thickness influence upon multi-level threshold resistive switching of amorphous $BaTiO_3$ (am-BTO) films in Ag/am-BTO/Ag cross-point structures", Thin Solid Films, 685 (2019) 59-65. http://doi.org/10.1016/j.tsf.2019.05.061, **(Impact factor: 2.03)**
3. **P. Muhammed Razi**, U. P. Mohammed Rasi, R. B. Gangineni, "Effect of Pressure on Dielectric Properties of Polyvinylidene Fluoride (PVDF) Polymer", AIP Conference Proceedings, 1665, 110049 (2015). https://doi.org/10.1063/1.4918105
4. **P. Muhammed Razi**, R. B. Gangineni, "In-plane ferroelectric studies on amorphous Barium Titanate (BTO) thin films in Ag/am-BTO/Ag parallel electrode structures, AIP Conference Proceedings **2265**, 030314 (2020). https://doi.org/10.1063/5.0016982 **(Best poster award)**

Conferences and Symposiums attended

1. **P. Muhammed Razi** & R. B. Gangineni, "In-plane ferroelectric studies on amorphous Barium Titanate thin film in Ag-BTO-Ag parallel electrode structures" 64th DAE Solid State Physics Symposium (DAE-SSPS 2019**), Indian Institute of Technology Jodhpur**, December 18-22, 2019, (Poster) (**Best poster award**)
2. **P. Muhammed Razi**, Rasi U. P, K. Pramod & R. B. Gangineni "Ferroelectric polarization in amorphous Ag/$BaTiO_3$/Ag parallel capacitor structures using constant current method & Resistive switching in Ag/$BaTiO_3$/Ag cross-point geometry", International Conference on Materials for Advanced Technologies (ICMAT), **Suntec, Singapore**, June 18–23, (2017). (Poster)
3. **P. Muhammed Razi**, U.P. Mohammad Rasi, K. Pramod & R. B. Gangineni. "Self-compliance resistive switching of amorphous $BaTiO_3$ thin films in Ag/$BaTiO_3$/Ag parallel capacitor structures". International Conference on Technologically Advanced Materials & Asian Meeting on Ferroelectricity (ICTAM-AMF10) November 7-11, 2016, **University of Delhi, New Delhi**-110007 India. (Poster)
4. **P. Muhammed Razi,** U. P. Mohammed Rasi & R. B. Gangineni, "Effect of Pressure on Dielectric Properties of Polyvinylidene Fluoride (PVDF) Polymer", 59th DAE Solid State Physics Symposium (DAE-SSPS 2014), **VIT University, Vellore**, Tamilnadu, India, December 16-20, 2014. (Poster)
5. **P Muhammed Razi**, M. S. Ravi Sankar & R B Gangineni ``Temperature-Dependent Magnetoresistance studies in Cobalt thin films deposited on patterned PVDF ". International Conference on Magnetic Materials and Applications (ICMAGMA-2015),02-04 December 2015, **VIT University, Vellore**, Tamilnadu, India. (Poster)
6. **P. Muhammed Razi**, U. P. Mohammed Rasi & R. B. Gangineni. ``Synthesis and Dielectric Studies of PVDF Coated Cobalt Composite". International Conference on Magnetic Materials and Applications (ICMAGMA-2014),15-17 September 2014, **Pondicherry University, Puducherry**, India. (Poster)
7. **P. Muhammed Razi** & R. B. Gangineni ``Magnetocapacitance studies on PVDF coated Cobalt magnetic composites". National Conference on Materials for Energy Conversion and Storage (NCMECS-2015),19-21 March 2015, **VIT University, Chennai** Campus, Tamilnadu, India. (Poster)

Schools and Workshops attended

1. UGC-SAP Sponsored Hands-on Workshop on LabVIEW, Dept. of Physics, **Pondicherry University**, India, December 14–18, (2015).
2. Workshop on Atomic force microscopy, sponsored by Bruker India, **IISc Bangalore**
3. INUP - Familiarization Workshop on Nanofabrication Technologies, May 26-28, 2014, Indian Nanoelectronics users program. **IIT Bombay**
4. UGC sponsored seminar on Structural analysis through X-ray diffraction (SAXD 2016),

January 28-29, 2016, Department of Physics, **Pondicherry University**.

5. Workshop on Spectroscopic Techniques(NMR/BDS/RAMAN), Central Instrumentation Facility (CIF), **Pondicherry University**, Puducherry, 30 April 2-3 May 2014
6. Workshop on computational techniques for energy materials, NCMECS 2015, March 19, 2015, **VIT Chennai**.
7. Workshop on nano-materials and nanotechnology, nano-mission-school, 23 October to 03 November 2017, **CeNS, Jalahalli, Bangalore**
8. Familiarization of HR-TEM and XPS, March 22-23, 2018. Organized under DST-Purse Phase 2, **Pondicherry University**, Puducherry, India
9. Awareness workshop on advanced material characterization and synthesis facilities, June 27-28, 2016, organized by **UGC-DAE consortium**, Kalpakkam node, department of nuclear physics, university of madras.

Educational Qualification

Sl. No.	Qualification	University / Institution
1	Bachelor of Science in Physics 2006 -2009	Calicut University Kozhikode, Kerala, India
2	Master of Science in Physics 2009 - 2013	Aligarh Muslim University Aligarh, UP, India
3	Bachelor of Education 2013-2014	Calicut University Kozhikode, Kerala, India
3	Doctorate (PhD) in Physics 2014 - 2020	Pondicherry University Puducherry, India