

Amit Kumar
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Education

Indian Institute of Technology, India	Materials Science and Eng.	B.Tech, 2005
Pennsylvania State University	Materials Science and Eng.	Ph.D., 2010

Professional Experience

2010–present	Postdoctoral Research Associate, Center for Nanophase Materials Sciences, ORNL
2005–2009	Graduate Research Assistant, Nonlinear optical Materials, Pennsylvania State University

Professional and Synergistic Activities

2006–present	Member: Materials Research Society
2011–present	Member: AVS
2010–present	Member: Electrochemical society
2009–present	Reviewer for four peer-reviewed journals.

Honors and Awards

2011	Microscopy Today Innovation Award for the development of Electrochemical Strain Microscopy.
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Publications: Over 30 publications.

Research Synopsis

- Dynamic electrochemical strain microscopy for nanoscale mapping of ionic phenomena and electrochemical reaction in energy materials*
 - Developed and employed dynamic electrochemical strain microscopy to measure Oxygen reduction reactions on the nanoscale in fuel cell cathodes and electrolytes.
 - Developed dynamic switching spectroscopy piezoforce microscopy as a tool to study relaxation behavior on the nanoscale in thin ferroelectric films.
 - Studied local ionic and electronic transport properties in ionic/oxide materials using SPM
- Nanoscale study of voltage activated oxygen reduction/evolution reactions in solid oxide fuel cell cathode materials*
 - Study of surface and bulk electrochemical processes on the LaAlO₃-SrTiO₃ surface using strain microscopy
 - Explore origin of charge writing on the LaAlO₃-SrTiO₃ surface

- Study of ionic transport during resistive switching in transition metal oxides
3. *Probing surface and bulk electrochemical processes in ionic oxide materials*
- Study of bias-dependent electrochemical gas-solid reactions in $(\text{La}_x\text{Sr}_{1-x})\text{CoO}_{3-\delta}$ cathode materials for fuel cells.
 - Exploration of electrochemical transformations underpinning electrocatalytic activity in cobaltites.
 - Study of electrochemical processes at elevated temperatures and controlled oxygen partial pressures in fuel cell electrolytes for evaluation of kinetic processes
4. *Nonlinear optical probing of multiferroic materials and strained ferroelectric oxides for potential multi-state memory devices (PhD Thesis)*
- Employed nonlinear optical techniques to study optical Second Harmonic Generation (SHG) in materials with simultaneous ferroelectric and magnetic ordering, automated data collection using LabView and built heaters and cryogenic systems to study the phenomena across wide temperature ranges.
 - Separated polar and magnetic symmetry using SHG and studied spin-charge coupling in multiferroics like PbVO_3 , BiFeO_3 and FeTiO_3 using electric and magnetic fields towards the goal of electric field switching of magnetic state.
 - Theoretical modeling of SHG signal to extract nonlinear optical coefficients of these materials
Utilized SHG and piezoresponse force microscopy (PFM) to study domain dynamics in Strained Ferroelectric films.
 - Studied Time dependant polarization switching and relaxor behavior in strained SrTiO_3 films
5. *Domain Imaging in Ferroelectric materials using confocal SHG and Raman Mapping*
- Designed and implemented a confocal SHG microscope to image ferroelectric and magnetic domains at variable temperatures and under variable electric fields.
 - Performed Confocal SHG and Raman mapping of domains and domain walls in Bismuth Ferrite and Iron Titanate .

Graduate and Postdoc Advisors:

Graduate Advisor: Prof. V. Gopalan (Pennsylvania State University)

Postdoc Advisors: S.V. Kalinin (Oak Ridge National Laboratory)