IEEE Magnetics Society Lecture – Electrical and Computer Engineering

Srinivasa Rao Singamaneni
Assistant Professor
Physics Department
University of Texas
Elpaso, TX

21 JUNE, 2018
1:00 PM
3043 ECpE Addition

Magnetic Properties of Multifunctional Materials Integrated on Si (100) Substrate

Abstract: After the first integration of SrTiO3 on silicon substrates by McKee and coauthors almost two decades ago1, there have been a growing research interest in integrating ferroelectric, multiferroic and magnetic materials2-6 with semiconducting materials such as Si (100), Ge, and GaN. Among all, Si (100) is a workhorse CMOS compatible substrate. This research activity is further fueled by recent push7 from the industry in realizing the nonvolatile low power computing applications for next generation memory and logic. This presentation discusses the major fundamental advances in the integration of multiferroic and magnetic materials onto ubiquitous silicon semiconductor platform, reported8-15 in the recent past in our group. This approach allows the integration of multifunctional materials on a silicon chip, where sensing, manipulation and rapid response function are combined for next generation 'smart' devices. In general, pulsed laser deposition has been used to grow these materials epitaxially on silicon substrates using the sequence of engineered buffer layers, but other techniques can also be used to extend the concepts developed here. Of particular interest, this presentation focuses on the resulting magnetic properties such as magnetization, coercive force, exchange bias of several important thin film heterostructures including two-phase multiferroics such as BiFeO3 (BFO)/La0.7Sr0.3MnO3 (LSMO), BaTiO3 (BTO)/LSMO, and heterostructures of two-ferromagnetic oxides such as LSMO/SrRuO3 (SRO). The discussion will also include our first attempt in studying the electric-field induced magnetism in BFO/LSMO heterostructures deposited on silicon substrates using polarized neutron reflectivity measurements. I conclude this presentation by highlighting the major bottlenecks and future directions. These significant materials advancements may herald a flurry of exciting new advances in CMOS-compatible multifunctional magnetic devices, in general.

Bio: Having completed his Ph.D. in 2008 (Physics) from the Indian Institute of Science, Bangalore, India, Dr. Singamaneni did INPAC Postdoc at University of Leuven, Belgium (2008-2011); and NRC/NAS postdoc at NC State, USA (2011-2016). Currently, he is an Assistant Professor at UTEP Physics since Fall 2016. He published about 60 peer-reviewed articles in all international journals. He is the member of APS, MRS, TMS, MMM, and international EPR society. He is the lead organizer of symposiums in TMS 2018, 2019 and MRS Spring 2019. He delivered about 15 invited talks, guided and co-guided about 27 students. His work on multiferroics, magnetic materials and graphene-derived materials has been recognized well in the scientific community with about 1200 citations (h-index of 16), and draw media attention as well. He has been the reviewer for major funding agencies such as NSF, DoD, and DOE; as well as major journals such as AIP, ACS, and APS. He received many awards including: Wiemer Family Endowment Award (2017, UTEP); NSF-PREM-IRG (2017-present); Emerging Materials Research Prize (October 2016), ICE Publishers, London; AIP Appreciation Award (2016); Young Scientist Award, INSA, India (2015); and secured several prestigious fellowships during the course of his research. His research interests include emerging multifunctional materials such as 2D materials, perovskite solar cells, multiferroic and ferroelectric materials and devices, thin film deposition, magnetism and magneto-transport studies, organic and inorganic spintronics, graphene based materials, electron spin/paramagnetic resonance spectroscopy, point and complex defects, semiconducting materials. Currently, he is leading the magnetic materials group in UTEP Physics department.