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MAJOR RESEARCH INTERESTS

My research group is one of the leading ones in the field of Oxide based Thin films. A new field “**Oxide Electronics**” was christened to cover these areas of research. We are focussed on the following areas:

1. Novel magnetic phenomena in oxides (Diluted magnetic oxides and Multiferroics)
2. Wide band gap oxides and nitrides (ZnMgO, TiO₂ and AlN)
3. Superhydrogenic Dopants in Oxides

In the area of diluted magnetic semiconducting oxides (**DMSO**), we have been one of the most active groups and have identified several host systems in which magnetic dopants such as Co lead to ferromagnetism with Curie temperatures in excess of room temperature. We have also been the first to point out the role of dopant clusters which could distort the data and the interpretation.

In the area of **wide bandgap Oxide** materials, we were the first to show the complete phase diagram of an alloy of ZnO and MgO, showing a single phase hexagonal phase from 0-40% Mg concentration and a cubic phase from 60-100% Mg concentration with mixed phases in between. We were the first to identify magnetic effects due to cation vacancies in TiO₂ and also transparent conductivity with Nb doping..

By doping wide bandgap oxides with dopants having large Bohr radius owing to the large dielectric constant of the material, one can have midgap states overlapping to form a band which may have unusual electronic or magnetic properties. This could lead to novel magnetic, superconducting materials.

RECENT PUBLICATIONS

1. Compositional origin of surface roughness variations in air-annealed ZnO single crystals. Pugel DE, Vispute RD, Hullavarad SS, et al. *APPLIED SURFACE SCIENCE* Volume: 254 Issue: 8 Pages: 2220-2223 Published: FEB 15 2008
2. Structural and chemical analysis of pulsed laser deposited Mg_xZn_{1-x}O hexagonal (x=0.15,0.28) and cubic (x=0.85) thin films. Hullavarad SS, Hullavarad NV, Pugel DE, et al. *OPTICAL MATERIALS* Volume: 30 Issue: 6 Pages: 993-1000 Published: FEB 2008
3. Chemical inhomogeneity and mixed-state ferromagnetism in diluted magnetic semiconductor Co : TiO₂. Ogale S, Kundaliya D, Mehraeen S, et al. *CHEMISTRY OF MATERIALS* Volume: 20 Issue: 4 Pages: 1344-1352 Published: FEB 26 2008
4. Stress relaxation of La_{1/2}Sr_{1/2}MnO₃ and La_{2/3}Ca_{1/3}MnO₃ at solid oxide fuel cell interfaces Lussier A, Dvorak J, Stadler S, et al. *THIN SOLID FILMS* Volume: 516 Issue: 6 Pages: 880-884 Published: JAN 30 2008
5. Growth parameter-property phase diagram for pulsed laser deposited transparent oxide conductor anatase Nb : TiO₂. Zhang SX, Dhar S, Yu W, et al. *APPLIED PHYSICS LETTERS* Volume: 91 Issue: 11 Article Number: 112113 Published: SEP 10 2007
6. Magnetism and anomalous hall effect in Co-(La,Sr)TiO₃. Zhang SX, Yu W, Ogale SB, et al. *PHYSICAL REVIEW B* Volume: 76 Issue: 8 Article Number: 085323 Published: AUG 2007
7. Homo- and hetero-epitaxial growth of hexagonal and cubic Mg_xZn_{1-x}O alloy thin films by pulsed laser deposition technique. Hullavarad SS, Hullavarad NV, Pugel DE, et al. *JOURNAL OF PHYSICS D-APPLIED PHYSICS* Volume: 40 Issue: 16 Pages: 4887-4895 Published: AUG 21 2007
8. Niobium doped TiO₂: Intrinsic transparent metallic anatase versus highly resistive rutile phase Zhang SX, Kundaliya DC, Yu W, et al. *JOURNAL OF APPLIED PHYSICS* Volume: 102 Issue: 1 Article Number: 013701 Published: JUL 1 2007
9. Epitaxy and recrystallization kinetics of TaC thin films on SiC for high temperature processing of semiconductor devices. Vispute RD, Hullavarad S, Luykx A, et al. *APPLIED PHYSICS LETTERS* Volume: 90 Issue: 24 Article Number: 241917 Published: JUN 11 2007
10. Low leakage current transport and high breakdown strength of pulsed laser deposited HfO₂/SiC metal-insulator-semiconductor device structures. Hullavarad SS, Pugel DE, Jones EB, et al. *JOURNAL OF ELECTRONIC MATERIALS* Volume: 36 Issue: 6 Pages: 648-653 Published: JUN 2007
11. Novel approaches to field modulation of electronic and magnetic properties of oxides. Venkatesan T, Kundaliya DC, Wu T, et al. *PHILOSOPHICAL MAGAZINE LETTERS* Volume: 87 Issue: 3-4 Pages: 279-292 Published: 2007