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Title of Ph.D. Thesis:	**Synthesis of ZnO based Nanophosphors for Applications in Solid State Light Emitting Devices**

Abstact

As ZnO has been shown to be a very bright emitter amongst wide band gap semiconductors, the idea is to develop ZnO based nanophosphors with suitable properties for application in Solid state Light Emitting devices. Such nanophosphors were prepared by chemical route and solid state reaction at high temperature. The precursor material (ZnO) is nontoxic and the dopants considered are alkali metals, alkaline earth metals, transition metals and rare earth ions so that a broad-band excitation in UV (200-400 nm) and tunable emission in the visible region could be obtained. ZnO itself is a luminescent material in UV due to excitonic emission and in the visible arising due to intrinsic defect levels in the forbidden gap. Doped ZnO can suitably modify and enhance the luminescence properties.

For ZnO nanophosphor based solid state light emitting devices with tunable emission, the requirements are:

- Tunable emission from ZnO,
- Successful production of p–type ZnO,
- Successful production of n–type ZnO

For Spintronic / Spin LED based on ZnO nanophosphor,the requirements are:

- Ferromagnetism at room temperature and above
- DMS without transition metal (preferable)

Towards this goal, the following achievements were made in the present work:

- Tunable emission from Blue to Red in ZnO nanphosphor doped with different group of elements,
- Achievement of p-type conductivity in alkali (Li/Na) doped ZnO nanocrysrals,
- Achievement of n-type conductivity in aluminium doped ZnO nanocrysrals,
- Achievement of dilute ferromagnetism in alkali (Li/Na) doped ZnO nanocrysrals at room temperature and upto 554 K.

The results of our findings are summarized below:

1. From photoluminescence studies it is found that ZnMgO nanophosphor films absorb near UV (330-400nm) and there is a broad emission in visible region. The luminescence enhances with Mg doping up to 62 times. The colorimetric coordinates are close to white light Development of ZnMgO nanophosphors hold promise for generation of white light.
2. Tuning of emission colours has been observed with transition metals as well as rare earth ions. Blue emission from Cr, green from Cu and red emission has been observed with Mn. Rare earth doped ZnO gives emission in the blue-green for Pr and orange red for Nd.
3. ZnO doped with alkali atom (Li,Na) has shown p-type conduction with measured hole concentration in the range of $\sim 10^{16}$-$10^{18} cm^{-3}$.
4. ZnO doped with Aluminium (Al) has shown n-type conductivity.
5. Li and Na doped ZnO have shown dilute ferromagnetism at room temperature and upto 554 K. The intrinsic nature of ferromagnetism in ZnO:Li has been established with the experimental observation of magnetic hysteresis loop, ferromagnetic resonance, and formation of magnetic domain structure. This is the first observation of DMS in ZnO without any doping of transition metal atom.