**Literature Review**

In 2005, R. Kaur et al. delved into the synthesis and characterization of yttrium-doped zinc oxide (YZO) films, produced through the sol-gel method and deposited using dip coating. The investigation focuses on films of various thicknesses, exploring the microstructural, electrical, and optical properties following post heat treatment. This study reveals the impact of annealing temperature and film thickness on the microstructure, crystallographic orientation, and overall quality of the films. Notably, the (002) preferential growth shifts to (101) with increasing film thickness, leading to the formation of natively textured films. The review sheds light on the intricacies of film properties, offering insights into the optimization of YZO films for specific applications.

In 2005, Ravinder Kaur et al. explored some developments in the deposition of undoped and yttrium-doped zinc oxide (YZO) thin films on Corning glass using the dip coating technique. Investigating the impact of yttrium doping (ranging from 0 to 4 wt%) and annealing temperature (ranging from 300 to 500 °C), this work provides a detailed analysis of the structural, optical, and electrical properties of the resulting films. The findings reveal crucial insights into the polycrystalline nature of the films, the preferential c-axis growth, absorption edge shifts, and the remarkable influence of yttrium doping on electrical resistivity and optical transmittance.

In 2006, Qingjiang Yu et al. provided a thorough examination of transparent and conductive ZnO thin films doped with yttrium, fabricated through the sol–gel method. The films, prepared using zinc acetate and yttrium chloride as cations sources, 2-methoxyethanol as a solvent, and mono-ethanolamine (MEA) as a sol stabilizer, are deposited on silica glass substrates by dip-coating. The study explores the influence of yttrium concentration, heating treatment, and annealing in a reducing atmosphere on the structural, morphological, electrical, and optical properties of the ZnO thin films.

In 2010, Jinghai Yang et al. explored the synthesis and characterization of yttrium-doped zinc oxide (Zn1−xYxO, x = 0, 0.03, 0.05) nanoparticles via the sol–gel technique. Investigating the impact of yttrium doping concentration on the structures, morphologies, and optical properties, this study sheds light on the successful incorporation of yttrium ions into the ZnO crystal lattice. The detailed examination of structural characterizations reveals distinct optical properties, including a UV emission at ∼383 nm and a broad deep-level emission with two Gauss peaks at 539 nm (P1) and 598 nm (P2). He observed optical changes with varying yttrium doping concentrations, providing a nuanced understanding of the unique optical behavior of yttrium-doped ZnO nanoparticles.

In 2012, Yogamalar et al. described the hydrothermal synthesis and absorption properties of cubic-shaped zinc oxide (ZnO) nanostructures doped with varying amounts of yttrium (Y) metal cations (0 to 15 at.%). The structural and optical properties of the chemically synthesized pure and Y-doped ZnO powders are investigated using a range of techniques, including powder X-ray diffraction (XRD), field emission scanning electron spectroscopy (FESEM), transmission electron microscopy (TEM), ultraviolet-visible (UV-vis) absorbance, photoluminescence (PL), and Fourier-transform infrared spectroscopy (FT-IR). This study revealed the complex relationship between dopant concentration and ZnO lattice behavior, emphasizing the impact on structural stability, optical bandgap energy, vibrational modes, and luminescence characteristics.

In 2012, Necmettin Kılınç et al. described the deposition and characterization of yttrium (Y)-doped zinc oxide (ZnO) thin films with Y concentrations of 1 at.%, 5 at.%, and 10 at%. The films were deposited on glass substrates using the sol–gel dip coating method. A detailed analysis of the electrical properties of the films across a range of temperatures reveals insights into the dominant conduction mechanisms, with a focus on thermally activated band conduction, Mott’s variable range hopping (VRH), and correlated barrier hopping (CBH) models. Additionally, this study investigates the NO2 sensing properties of the films, demonstrating high sensitivity and a notable response for 1 at.% Y-doped ZnO film at 200 °C.

In 2013, Qingjiang Yu et al. provided a detailed analysis of the structural, electrical, and optical properties of yttrium-doped zinc oxide (YZO) thin films deposited on silica glass substrates via the sol–gel method. This investigation systematically explores the influence of yttrium doping on the crystallographic orientation, electrical resistivity, and photoluminescence characteristics of the thin films. This study emphasizes the impact of annealing conditions in a reducing atmosphere on the electrical properties and highlights the absence of a specific green emission in the yttrium-doped films, presenting a nuanced understanding of the role of yttrium in modulating the properties of ZnO thin films.

In 2014, Sungeun Heo et al. showed that the sol-gel synthesis method has emerged as a versatile approach for the fabrication of thin films with tailored properties. In particular, the incorporation of yttrium (Y) dopants into zinc oxide (ZnO) thin films has been a subject of increasing interest due to its significant impact on various physical properties. He provided an overview of recent advancements in the sol-gel synthesis of Y-doped ZnO (YZO) thin films and their implications for surface, structural, optical, and electrical properties in this work.

In 2015, M. Thirumoorthi et al. examined the successful deposition of both undoped and yttrium (Y)-doped zinc oxide (ZnO) thin films using the sol–gel spin coating method. With varying Y concentrations, this study provides a detailed analysis of the structural, morphological, optical, and electrical properties of the films. This investigation, utilizing techniques such as X-ray diffraction (XRD), scanning electron microscopy (SEM), energy-dispersive X-ray spectroscopy (EDX), optical transmittance, photoluminescence (PL), Fourier-transform infrared spectroscopy (FTIR), and Hall measurements, offers insights into the crystalline structure, surface morphology, elemental composition, optical transparency, bandgap variations, emission shifts, chemical bonding, and conductivity of the films.

In 2015, Parmod Kumar et al. investigated the influence of yttrium (Y) doping concentration (1–5%) on the structural, morphological, and optical properties of sol–gel synthesized Zn1−xYxO samples. This study reveals a critical transition point at x≥0.03 where phase segregation of Y2O3 occurs, leading to a departure from the pure ZnO wurtzite structure. X-ray diffraction patterns, supported by scanning electron microscopy, photoluminescence, and Raman spectroscopy, elucidate the impact of differing charge states, ionic radii, and coordination numbers of host lattice and dopant ions on the observed phase segregation phenomena.

In 2015, Sanjeev Kumar Sharma et al. explored the synthesis and characterization of self-assembled 3D flower-like yttrium-doped zinc oxide (YZO) microstructures composed of nanorods. Prepared through hydrothermal-precipitation, these YZO nanoflowers are subjected to comprehensive morphological, structural, and compositional characterizations. This study confirms a well-crystallized wurtzite hexagonal phase through various techniques, including X-ray photoelectron spectroscopy (XPS) of YZO nanopowder, which reveals distinct yttrium 3d core level spectra. Investigating the antibacterial activity of YZO nanoflowers against both gram-positive and gram-negative microorganisms, this study observes enhanced antibacterial properties attributed to the incorporation of yttrium (Y: 2 at.%). He focused on the potential of YZO nanocomposites as effective antibacterial agents with applications in infection control and highlights their fast antibacterial activity as a crucial attribute in hindering the re-emergence of infections.

In 2015, Narinder Kaur et al. investigated about the stress relaxation dynamics and its profound influence on the bandgap modulation of Yttrium-doped Zinc Oxide (YZO) thin films. The study, which involves the deposition of YZO thin films on quartz glass via spin coating followed by vacuum annealing, scrutinizes the preferred (002) orientation observed in all annealed YZO films. Photoluminescence (PL) spectroscopy emerges as a powerful tool, providing direct evidence of bandgap shifts linked to stress relief phenomena during thermal annealing. The study establishes a nuanced relationship between the annealing temperature, stress relaxation, and the resultant alterations in the bandgap of YZO thin films.

In 2018, O. Bazta et al. examined recent developments in the deposition of highly transparent, n-type zinc oxide (ZnO) thin films on glass substrates using spray pyrolysis processing. He focused on the simultaneous incorporation of yttrium (Y) dopants at varying concentrations (0, 2, 5, 7 at.%) to explore their impact on the structural, morphological, and optical properties of ZnO:Y thin films. The investigation aimed to elucidate the potential of these films for optoelectronic applications. Characterization techniques, including X-ray diffraction, field-emission scanning electron microscopy (FESEM), UV-visible absorbance measurements, and photoluminescence (PL) and cathodoluminescence (CL) spectroscopy, are employed to unveil the intricate details of the synthesized thin films.