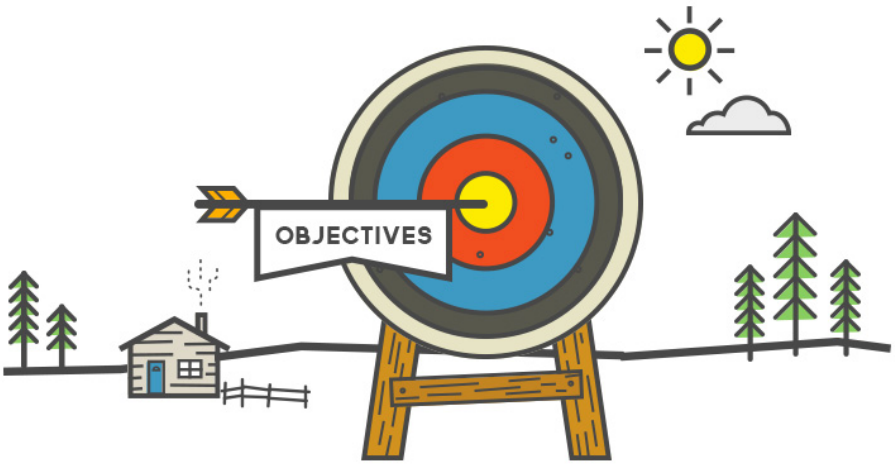

Chapter 3

Aims and Objectives of the Present Work

CHAPTER 3
Aims and Objectives of the Present Investigations

The aims and objectives of present investigations are focused on the preparation and characterization of some dope and co-dope varistor material in the ZnO-V_2O_5 varistor ceramic. On the basis of the results of the initial work a detailed work plan was prepared to explore the optimum composition and processing parameters for development of ZnO-V_2O_5 varistor ceramics with good electrical and electronics properties. The characteristics of materials also depend on doping them with suitable dopants and additives as secondary phases. Therefore, in order to investigate the effect of doping we have selected transition metal oxide MnO, Nb_2O_5, Cr_2O_3 and ZrO_2 selected compositions of ZnO-V_2O_5 varistor ceramics. These compositions were processed with optimum sintering schedule to study the effect of doping on electrical and structural behavior.

The aims and objectives of the present work are as follows:

Preparation

1. **Synthesis of Nb_2O_5-doped ZnO–V_2O_5 ceramics systems**: Five compositions (99.50 - x) mol% ZnO + 0.5 mol% V_2O_5 + x- mol% Nb_2O_5 (where x = 0.00, 0.05, 0.10, 0.25 and 0.50) were prepared using solid state reaction.
2. **Synthesis of MnO-doped ZnO–V_2O_5–Nb_2O_5 ceramics systems:** Five compositions (99.4 - x) mol% ZnO + 0.5 mol% V_2O_5 + 0.10 mol% Nb_2O_5+ x-mol% MnO/$MnCO_3$ (where x = 0.00, 1.50, 2.00, 2.50 and 3.00) were prepared using solid state reaction.
3. **Synthesis of ZrO_2-doped ZnO–V_2O_5–Cr_2O_3 ceramics systems*:*** Five compositions (96.5 - x) mol% ZnO + 0.5 mol% V_2O_5 + 3.0 mol% Cr_2O_3 + x-mol% ZrO_2 (where x = 0.00, 0.10, 0.50, 1.00 and 2.00) were prepared using solid state reaction.

All the compositions were **sintered at 850°C, 900°C and 950°C** to study the effect of composition and sintering temperature on the microstructure and the influence of the grain boundary structure on the electrical properties of ZnO based varistor ceramics in a systematic manner using AC impedance spectroscopy (IS).

Structural Characterization

- To determine the density of the specimens sintered under different conditions and study their densification behavior.
- To determine the phases in different specimens using X-Ray Diffraction (XRD) and study the effect of composition and processing parameters on the development of phases during sintering in ZnO-V_2O_5varistor ceramics.
- To determine the lattice parameters of different specimens using unit cell software and study the effect of composition and processing parameters on lattice parameters in ZnO-V_2O_5varistor ceramics.
- To determine the microstructure using scanning electron microscope (SEM) and study the effect of composition and processing parameters on development of microstructure of the ZnO-V_2O_5varistor ceramics.
- To determine the composition of the specimens as whole or different regions of the microstructure using Energy-dispersive X-ray spectroscopy (EDS) studies of the synthesized specimens.

Electrical Characterization

1. To study the effect of composition and processing parameters on the following varistor characteristics of the ZnO–V_2O_5 based varistor ceramics.
   (a) Non-linear coefficient,
   (b) Breakdown Field and
   (c) Leakage current density

2. To measure the dielectric coefficients of the ZnO varistor ceramic using NOVA impedance analyzer.
3. To study the effects of doping on liquid-phase sintered ZnO–V_2O_5 based varistor ceramics using alternate current impedance spectroscopy.

The next chapter 4 will discuss about the various synthesis and characterization methods undertaken in the present thesis.