# Table of Contents

Acknowledgement (i)  
Abstract (ii)  
List of tables (iv)  
List of figures (vi)  

1 **Introduction** 1-60  
1.1 Chemical composition of hexaferrites  
1.2 Crystal structure of M-type hexaferrite  
1.3 Magnetic structure of M-type hexaferrite  
1.4 Magnetism in ferrites materials  
1.4.1 Classification of magnetic materials  
1.5 Properties of strontium-barium M-type hexaferrite  
1.5.1 Magnetic properties  
1.5.2 Electrical and dielectric properties  
1.5.3 Thermal properties  
1.5.4 Chemical stability  
1.6 Applications of strontium-barium M-type hexaferrites  
1.7 Literature survey of M-type hexaferrites  
1.8 Objectives and plan of work  

2 **Experimental** 61-85  
2.1 Chemicals used  
2.2 Methods of preparation  
2.2.1 Co-precipitation Method  
2.2.2 Sample preparation  
2.3 Characterization techniques  
2.3.1 Thermal analysis  
2.3.2 Structural analysis  
2.3.2.1 X-ray diffraction  
2.3.2.2 Scanning electron microscopy  
2.3.2.3 Tunneling electron microscopy
2.3.3 Electrical properties
  2.3.3.1 DC-electrical resistivity measurements
  2.3.3.2 Dielectric properties

2.3.4 Magnetic properties
  2.3.4.1 AC-magnetic susceptibility measurements
  2.3.4.2 DC-magnetization measurements
  2.3.4.3 Mössbauer analysis

3 Results and Discussion

3.1 Thermal analysis
3.2 Structural analyses
  3.2.1 X-ray diffraction studies of Sr-Ba hexaferrites
    3.2.1.1 Optimization of annealing temperature for the phase formation
    3.2.1.2 XRD patterns of RE-Ni doped strontium-barium hexaferrites
    3.2.1.3 Lattice constants \((a \& c)\) and cell volume \((V_{cell})\)
    3.2.1.4 X-ray density \((d_X)\) and bulk density \((d_b)\)
    3.2.1.5 Crystallite size \((D)\)
  3.2.2 Scanning electron microscopic analysis

3.2 Electrical properties
  3.3.1 DC-electrical resistivity measurements
    3.3.1.1 Variation of resistivity \((\rho)\) with temperature
    3.3.1.2 Doping effect on resistivity \((\rho)\)
    3.3.1.3 Activation energy for hopping \((E_a)\)
    3.3.1.4 Drift mobility \((\mu_d)\) of charge carriers
  3.3.2 Dielectric properties
    3.3.2.1 Effect of applied field frequency on dielectric constant
    3.3.2.2 Effect of applied field frequency on dielectric loss
    3.3.2.3 Doping effect on dielectric parameters

3.4 Magnetic properties
  3.4.1 AC-magnetic susceptibility measurements
    3.4.1.1 Variation of AC-magnetic susceptibility \((\chi)\) with temperature
    3.4.1.2 Doping effect on the Curie temperature \((T_c)\)
  3.4.2 DC-magnetization measurements
3.4.2.1 Doping effect on the saturation magnetization
3.4.2.2 Doping effect on the remanence magnetization
3.4.2.3 Doping effect on the coercivity
3.4.3 Mössbauer studies
   3.4.3.1 Mössbauer spectra of RE-Ni doped Sr-Ba hexaferrites
   3.4.3.2 Doping effect on hyperfine field
   3.4.3.3 Doping effect on isomer shift
   3.4.3.4 Doping effect on quadrupole splitting
   3.4.3.5 Doping effect on site population of iron ions

4. Conclusions
5. Recommendations for further research

References

List of publications