Ceramic magnetic materials used in various devices have the inherent drawback that they are not easily machinable to obtain complex shapes. Plastic magnets and elastomer magnets, on the other hand have several advantages, as they are flexible, easily machinable and mouldable. They are light in weight and low in cost. Hence plastic magnets and rubber ferrite composites have the potential in replacing the conventional ceramic type of magnetic materials for applications where flexibility is an important criterion. Moreover, these composites are also important because of their microwave absorbing properties. Recent studies have indicated that the addition of fillers like carbon black on rubber ferrite composites enhances the microwave absorbing properties of the composites. Hence, studies pertaining to the incorporation of carbon black along with magnetic fillers in elastomer matrixes assume significance.

The hard ferrites are an important class among the ferrite materials due to their importance as permanent magnets and high density magnetic recording media. Since their discovery by Philips in 1950’s, the M-type hexaferrite have continued to be of great interest for applications such as permanent magnets, plastoferrites, injection-moulded pieces, microwave devices and magnetic recording media. This is because of their relatively high coercivity, excellent chemical stability and corrosion resistance. Furthermore, their magnetic properties can be modified for various applications by proper choice of the constituents and appropriate preparative techniques.

In the present study the preparation and characterisation of rubber ferrite composites (RFC) containing barium ferrite (BaF) and strontium ferrite (SrF) have been dealt with. The incorporation of the hard ferrites into natural and nitrile rubber was carried out according to a specific recipe for various loadings of magnetic fillers. For this, the ferrite materials namely barium ferrite and strontium ferrite having the general formula MO\(_6\)Fe\(_2\)O\(_3\) have been prepared by the conventional ceramic techniques. After characterisation they were incorporated into the natural and nitrile rubber matrix by mechanical method. Carbon black was also
incorporated at different loading into the rubber ferrite composites to study its
effect on various properties. The cure characteristics, mechanical, dielectric and
magnetic properties of these composites were evaluated. The ac electrical
conductivity of both the ceramic ferrites and rubber ferrite composites were also
calculated using a simple relation. The results are correlated.

The results of the investigation on the 'Evaluation of Magnetic, Dielectric
and Mechanical Properties of Rubber Ferrite Composites' in this thesis are
classified into seven chapters.

**Chapter 1** gives a general introduction on the natural and synthetic rubber.
Magnetic materials, their classification and applications are also dealt with in this
chapter. A brief introduction to ferrites, magnetoplumbite structure and rubber
ferrite composites are also provided in this chapter.

An outline about the equipment, materials used and the experimental
techniques employed for the preparation and characterisation of samples are
included in **Chapter 2**. The instruments used and the procedures adopted for the
measurement of mechanical, dielectric and magnetic properties at various stages
are also cited in this chapter.

**Chapter 3** deals with the preparation and characterisation of the ferrites and
its incorporation into rubber matrixes. Structural evaluations of the prepared BaF
and SrF samples were carried out using X-ray diffraction (XRD) method. These
samples were checked for their monophasic characteristics before they were
incorporated into the matrix. RFCs were prepared by incorporating these
precharacterised powder samples at various loading into natural and nitrile rubber
according to a specific recipe. The preparation of RFCs containing carbon black is
also included in this chapter.

The cure characteristics and mechanical properties of the RFCs are discussed
in **Chapter 4**. Cure characteristics of the RFCs were carried out using a Goettfert
Elastograph model 67.85. Vulcanisation of these samples was then done on an
electrically heated hydraulic press up to their respective cure times. The
mechanical properties of these prepared RFCs were found out using an Instron
Universal Testing Machine (UTM), model 4411 Test System.
The dielectric studies of these magnetic fillers and RFCs were carried out using a dielectric cell and an impedance analyser, model: HP 4285A in the frequency ranges from 100 KHz to 8 MHz and are presented in Chapter 5.

Magnetic properties of both ceramic fillers and RFCs were evaluated and dealt in Chapter 6. The correlation of the properties was carried out with a view to tailor making materials with specific magnetic properties. The variation of coercivity, saturation magnetisation and magnetic remanence for different filler loadings were compared and correlated. Magnetic measurements of ceramic BaF, SrF and the RFCs were carried out using vibrating sample magnetometer (VSM), model: 4500 (EG&G PARC).

Chapter 7 is the concluding chapter of the thesis. In this chapter, the important observations and results are discussed and compared. Commercial and technical importance of RFCs and its possible applications are discussed in this chapter. The scope for further work is also dealt with in this chapter.