

Preface

The dissertation titled **Studies on structural, thermal and magnetic properties of $R_2Fe_{14}B$ ($R = Pr, Nd$) permanent magnet materials** is submitted for the degree of Doctor of Philosophy to Indian Institute of Technology, Kharagpur, India. The investigation has been carried out in National Metallurgical Laboratory, Jamshedpur and in Indian Institute of Technology, Kharagpur. A few experiments, which have been carried out in other organisations, have been duly acknowledged.

The present dissertation is divided into eight chapters. Chapter 1 is an introductory chapter which aims to justify the study on the structural, thermal and magnetic properties of $R_2Fe_{14}B$ permanent magnet materials and sets a few objectives as guidelines for the present investigation. Chapter 2 revisits the development of permanent magnet materials, in general, and the development of $R_2Fe_{14}B$ intermetallics, in particular and presents the state of art of the structural, thermal and magnetic studies of $R_2Fe_{14}B$. Chapter 3 reports studies on the effects of a partial Co substitution on the structural, thermal and magnetic properties of $Pr_2Fe_{14}B$ permanent magnet materials, synthesised by the rapid solidification process. Chapter 4 presents the studies on the effects of a partial Co substitution on the less favourable properties of $Nd_2Fe_{14}B$ microcrystals, synthesised by the oxide reduction diffusion process. Chapter 5 analyses the effects of interstitial H atoms in $Nd_2Fe_{14-x}Co_xB$, $x \leq 3$. Chapter 6 incorporates studies on the thermal desorption of interstitial H atoms in $Nd_2Fe_{14-x}Co_xBH_y$, $x \leq 3$, $y \leq 5$ hydrides, by Differential Scanning Calorimetry (DSC) and Differential Thermal Analysis. Chapter 7 proposes a micromagnetic model of ferromagnetic $Nd_2Fe_{14}B$ grains with anti phase (diamagnetic) boundaries at the diamagnetic grain surfaces to explain the anomalous temperature dependence of coercivity in $Nd_2Fe_{14}B$. Chapter 8 is the concluding chapter, which presents a summary of the research work undertaken in the present investigation and overviews all the conclusions drawn in the previous chapters. This chapter also throws open the vistas of future scope of work in related fields.

Swati Haldar