Preface

A survey of pertinent literature reveals a growing interest in research on inorganic and organometallic polymers. Recently, boron and silicon containing polymers have received much attention as they find end-use as high temperature polymers, precursors for ceramic fibers and coatings, matrix resins for ceramic matrix composites and atomic oxygen (AO) resistant coatings. The present study has, therefore, been undertaken with a view to synthesizing novel borosiloxane oligomers from boric acid and alkoxysilane, and studying the ceramic conversion of these materials. Another part of the work deals with the thermal degradation of polysilahydrocarbons synthesized using cheaper raw materials like styrene and diorganodichlorosilanes and the evaluation of these polymers as AO resistant materials.

Chapter 1 opens-up with a general introduction to inorganic and organometallic polymers and provides a brief history of the developments of different silicon containing polymers, boron containing polymers and boron and silicon containing polymers. End-uses of these polymers as precursors for ceramics, matrix resins for CMC and oxidation resistant coatings are also presented. The introductory chapter concludes with the discussion on the objective and scope of the present investigation.

Chapter 2 deals with the materials used, experimental procedures and the analytical techniques used in the present study.

Chapter 3, divided into seven parts, presents the results and discussion. Chapter 3.1 deals with the synthesis and characterization of borosiloxane oligomers from boric acid and different alkoxysilanes. The effect of reaction time, catalyst and solvent on the properties of the oligomers is dealt with. Synthesis of epoxy-functionalized borosiloxane oligomers are presented in Chapter 3.2.

Chapter 3.3 presents the solventless synthesis of borosiloxane oligomers from different alkoxysilanes. Chapter 3.4 discusses the ceramic conversion of certain selected borosiloxane oligomers synthesized in the present study. Chapter 3.5 deals with the end-uses of the borosiloxane oligomers as oxidation
resistant coatings for carbon-carbon composites and also as matrix resins for ceramic matrix composites. Chapter 3.6 discusses the thermal degradation kinetics of polysilahydrocarbons. The evaluation of AO resistance of different polysilahydrocarbons and its comparison with other inorganic polymers are presented in Chapter 3.7. Chapter 4 summarizes the findings of the present investigation together with some concluding remarks and scope for further work.

The research work presented in the thesis has resulted in a number of patents and research publications. Two patent applications have been approved and five more patent applications are under preparation. Three research papers have already been published, four research papers have been communicated and six research papers are under preparation. In addition to the above patents and publications, the research work has been presented extensively in National and International Conferences.