PREFACE

Metal matrix composites (MMCs) are nonequilibrium mixtures of metals and ceramics where there are no thermodynamic restrictions on the relative volume percentages, shape and size of the ceramic phases. By carefully controlling the relative amounts and distribution of the ingredients constituting a composite, as well as by controlling the processing conditions, MMCs can be imparted with a tailored set of useful engineering properties which cannot be realized with conventional monolithic materials. Literature available on the processing methods/techniques and on the study of the structure and properties of particulate metal matrix composites reveal that they offer isotropic properties, increased service temperature, improved specific mechanical and thermal properties over the existing alloys. Tailorability of the properties of these materials for specific requirements make them suitable in a variety of applications in critical sectors such as aerospace, space shuttle, defence, automobile and general engineering applications. The lack of appropriate quality criterion posed limitations for their use. Hence, an attempt has been made for the synthesis of aluminium based metal matrix composite and to study the effect of the processing parameters on the strength property of the matrix. The study and the results are presented in this thesis.

The first chapter is a brief review of the earlier studies carried out on the synthesis and characterization of metal matrix composites.
The second chapter discusses the preparation of Al-SiCp metal matrix composite by liquid metallurgy and by rheocasting routes. Preliminary evaluation of the cast billet for volumetric defects using x-rays, microstructure evaluation and its impact on the strength property are also included.

Third chapter contains the account of the intensive study of the macro and microstructure of the composite by x-rays optical microscopy and scanning electron microscopy. The integrity of the structure of the composites and its dependence on the Young's modulus and fracture toughness are determined.

Fourth chapter contains the details of the nondestructive evaluation of the composite using ultrasonics. A quality criterion is arrived from the attenuation and velocity measurements. An appropriate theoretical model of the composite is also presented.

Fifth chapter summarises the results of the studies on the preparation and characterization of Al-SiCp metal matrix composite. Its applications in the engineering field and the scope of further studies are cited.