ACKNOWLEDGEMENT

I take this opportunity to express my deep sense of gratitude and indebtedness to my Supervisors, Prof. S. Brahmagi Rao and Dr. M. S. Vijayaraghavan for their keen and dynamic guidance, invaluable advice, encouragement and stimulating discussions throughout the course of this work with infinite patience.

I acknowledge the encouragement and inspiration given to me by the then Director Dr. E. Bhagiratha Rao and also to the continued encouragement given by the present Director Shri K. Swaminathan to complete the work.

I am immensely grateful and indebted to Dr. T. R. S. Reddy, Dy. Director, Head of Hybrid Microelectronics Division, DLRL, Hyderabad for his keen interest, valuable advice and constant encouragement throughout the work.

I would like to place on record the help and cooperation given by Shri C. Anjaneyulu, Smt. Vasundhara and Smt. Arunakumari and all other Officers and Staff of Hybrid Microelectronics Division, DLRL, Hyderabad.

I wish to express my indebtedness to Shri S. Sundaram, Head Microwave Wing of DLRL for identifying the problem of Ferrite Metallisation for an ongoing IGMDP Project and encouragement given to me throughout the course of the work. I am very much thankful to Shri Srinivasa Rao, Shri Madhava Rao and Shri Badnikar of Microwave Wing for all Microwave measurements.

I acknowledge the help and encouragement given by Officers and Staff of Printed Circuit Division and to Shri K. C. Verma and Shri Prasad of Photography section for the excellent photographs. I also thank Shri Victor and Shri Satyanarayana of Design Engineering Group as well as Officers and Staff of TIC Division.
I am very much thankful to the management of BHEL (R&D) Vikasnagar, Hyderabad and in particular to Mrs. P. Tiku, Senior Manager and Dr. V. Rama Murthy, Senior Manager of Material Science Laboratory for extending their encouragement and valuable discussions. It is a great pleasure to acknowledge with sincere thanks to Shri S. Prithvi Raj of BHEL (R&D) Vikasnagar, Hyderabad for his help during Ion Plating experiments and all other staff who have helped at various stages of the work.

I thank my friend Dr. S. Venkataraman and Dr. Laxmi for valuable discussions and help given to me. I am also grateful to Prof. V. V. Sastry for his co-operation and advice.

I sincerely acknowledge the help given to me by Smt. NAGA LAXMI of DLRL, Shri SUNIL DHAR, Shri SATISH KUMAR GUPTA and Shri A. VENKAT RAO and all other Staff members of DESIDOC PP UNIT for their excellent preparation of this report.

My thanks are also due to Dr. Srinivasan, Dr. S. Savitry and Shri K. Muralikrishna for helping me at various stages of the dissertation.

Finally I thank my wife and children without whose invaluable encouragement, co-operation and inspiration, this work would not have been successfully completed.
ABSTRACT

Basic to the fabrication of Microwave components (and therefore to Microwave subsystems) towards the development of Electronic Warfare systems, is the availability of metallised substrates such as Alumina, Quartz, Sapphire, Ferrites/garnets, Teflon and flexible Teflon-based substrates. The thesis investigates various techniques of metallising afore-mentioned materials in order to arrive at a suitable metallisation process for use in the fabrication of MIC components. In particular, the most appropriate and cost effective technique for depositing copper thin films on these hard and flexible substrates has been suggested in order to establish an indigenous base to fabricate these metallised substrates for MW component industry.

After examining the various options available, the author has suggested the following:-

Ion plating is the most suitable technique to deposit copper films of sufficient purity and adhesion to the extremely smooth ferrites and alumina substrates. Besides, the films deposited using this process have desired Microwave propagation loss for use in Hybrid MIC based Microwave components.

Electroless deposition of copper on pure teflon and glass-reinforced teflon substrates results in films having good uniformity, adhesion, etchability and acceptable Microwave loss. One of the outstanding results of developing a process for metallising Teflon is the successful fabrication of a conical log spiral antenna having metallised spiral track etched directly on the solid three dimensional cone-a process available only in selected advanced industrial houses in the world.

Summing up, the thesis has suggested few process techniques for fabricating metallised ultra smooth ferrites, alumina, PTFE and PTFE based materials which were hitherto totally imported from abroad.