ACKNOWLEDGEMENTS

Perhaps there is not enough space or time to thank the many individuals who at some point or another helped me to complete this thesis.

I would first like to acknowledge my thesis supervisors, Dr. T.S. Sidhu, Director, Shaheed Bhagat Singh College of Engineering and Technology (SBSCET), Ferozepur, and Dr. R.S. Walia, Assistant Professor, Department of Production Engineering, PEC University of Technology, Chandigarh for their patient guidance, encouragement and untiring efforts throughout the tenure of this work. They have been an inspiring and driving force during the course of this work. Without their timely help, intellectual input, constructive criticism and painstaking efforts, it would not have been possible for me to complete this thesis in the present form. Their families deserved my sincere acknowledgements too.

I express sincere thanks to my research committee members: Prof. Satya Prakash, Prof. Surendra Singh, Dr. Buta Singh and Dr. Sehijpal Singh Khangura for their time and energy in reviewing this thesis.

Deep sense of gratitude is acknowledged to Dr. Paramjeet Singh, Ex-Director, Swami Vivekanand Institute of Engineering and Technology, Punjab, who was kind enough to recommend me to pursue Ph.D. The financial support rendered by Mr. Ashwani Garg and Mr. Ashok Garg, Shri Raghunath Rai Memorial Educational and Charitable Trust, Mohali is highly acknowledged.

I wish to record my deep gratitude to Dr. H.S. Shan, Dr. Pradeep Kumar, Professor IIT Roorkee, Dr. Harpreet Singh, Assistant Professor, IIT Ropar, Dr. B.S. Pabla Professor and Head, NITTTR Chandigarh, and Dr. Manoj Datta, Director, Dr. A.M. Kalra, Deputy Director, Dr. Arun .K. Lall, Head Mechanical Engineering Department, Dr. V.P. Singh, Ex-Head Mechanical Engineering Department, Dr. Parveen Kalra, Ex-Head Production Engineering Department, PEC University of Technology, Chandigarh, Prof. L.D. Garg, Dr. Manpreet Kaur, and Dr. Niraj Bala, Assistant Professor, BBSBEC Fatehgarh Sahib, for their co-operation and support in carrying out the experimental and analysis work in their institutes/departments.

Several individuals of the technical and administrative staff of PEC University of Technology deserve my sincere thanks and gratitude, in particular Dr. P.J. Singh, Dr. Sushant Samir, Dr. Sanjeev Kumar, Dr. D.R. Prajapati, Mr. Sanjay Batish, Mr. Sushil Kumar, Ms. Kamaljeet Kaur, Ms. Sonu and Ms. Shallu.
Many thanks go to Mr. S.D. Sharma and Dr. Kamal Lochan Pruseth of Institute Instrumentation Centre, IIT, Roorkee, Mr. Amit Kumar, and Ms. Narinder Kaur of Indian Institute of Technology (IIT), Ropar for carrying out XRD, SEM and EPMA work. Thanks are also due to Mr. Pankaj Kumar for typesetting of thesis manuscript.

I am highly obliged to Prof. Andre’ McDonald, Professor, Mechanical Engineering, University of Alberta, Edmonton, Canada, Dr. Shrikant Joshi, Scientist, International Advanced Research Centre (IARC) for Powder Metallurgy and New Materials, Hyderabad, P.Eng. Gagandeep Singh Sidhu, Manufacturing and Quality Engineer, Halliburton, Edmonton, Mr. Preet Inder Singh Jassi, Network Engineer, Baltimore, USA, Mr. Ran Mohan Jeet Singh Sidhu, Director, Products, Red Cedar Technology, Michigan, USA, for extending their support and facilities to perform the experimental work.

I would like to express my sincere gratitude for the library staff of IIT Roorkee, IIT Kanpur, IIT Delhi, IIT Mumbai, IIT Ropar, and PEC University of Technology, Chandigarh for their kind co-operation to carry out the literature survey.

Many thanks are due to my colleagues from Mechanical and Production Engineering Departments of PEC University of Technology, Chandigarh and Swami Vivekanand Institute of Engineering and Technology (SVIET), Banur who have to put extra efforts during the period of my Ph.D work.

I wish to thank my friends and colleagues for their moral support and camaraderie help to keep things in perspective, in particular Mr. Jujhar Singh, Mr. Anuranjan Sharda, Pandit Shankar Parsad Shastri, Mr. Prince Sharma, Mr. Prabhjit Singh, Infosys, USA, Mr. Iqbal Inder Singh Jassi, Mr. Shanan Goyal, Mr. Gurpal Singh, Mr. Vishal Gupta, Dr. Manoj Mittal, Dr. Manoj Bali, Mr. Satish Kansal, Mr. Amarpreet Singh, Mr. Harpreet Singh Oberoi, Mr. Amandeep Nanda, Mr. Sarabjeet Singh Arora, and Mr. Vijay Kumar. Special thanks go to Mr. Vikas Bansal, and Mr. Gaurav Bansal, Mr. Arun Garg and Mr. Deepak Aggarwal for their everlasting support.

I would like to humbly dedicate this thesis to my parents who are the spirit and source of inspiration behind this research work. I would like to express my reverence and great admiration for parents-in-law, sisters-in-law, and brothers-in law, who have always been the inspiring and encouraging force for me. I am highly grateful to my brothers, sisters, sisters-in-law, nephews and nieces for their continual co-operation during the course of this work. I am especially grateful to my brother in law, Ashok Bansal, who motivates me to try to be as creative and to work hard as he is.

A sense of apology is due from my sweet and loving sons Naman Goyal and Archit Goyal, who missed many precious moments of their childhood from fatherly love and care. A sense of forgiveness is recorded for them as they missed the help and
enthusiasm expected from me during their birthday celebrations. My wife, Shally Goyal, deserves special thanks and grand appreciation who gave her best in looking after the growing kids during the tenure of this work by sacrificing her comforts. I am falling short of words to express gratitude to her for the determination she has shown to bear extra household responsibilities during the tenure of this work.

Above all, I am highly indebted to ALMIGHTY GOD who blessed me with spiritual support and fortitude at each and every stage of this work.