

# Preface

The manufacturing industry contributes a major share in the development of a nation. However, it is now facing several challenges such as rapid product development, flexibility, low to medium volume, and low-cost production. Many advanced/unconventional technologies/tools are being developed worldwide to face these challenges. Among these technologies laser has become quite popular due to its ability for precise focusing and ease in controlling the heat source. Researchers worldwide are now focusing their attention on improving productivity and product quality in the application of laser technology for the manufacture of components required for consumer electronics, aerospace systems and vehicles, bio-medical instrumentation, automobiles, and shipbuilding applications. Scientists, researchers, and engineers across the globe are striving to achieve excellence in the area of laser-based manufacturing by carrying out systematic experimental as well as numerical studies. The present book represents some of these efforts.

The chapters in this book present the basic and advanced topics in laser-based manufacturing. These chapters focus on theoretical as well as practical aspects of laser technology for various applications such as sheet metal bending, welding, sintering and micro-manufacturing, viz., micro-channelling, micro-turning, micro-drilling, etc. These chapters are the extended versions of peer-reviewed manuscripts presented at the 5th International and the 26th All India Manufacturing Technology, Design and Research (AIMTDR) conference held during December 12–14, 2014 at the Indian Institute of Technology Guwahati, India. The book will be useful to researchers and practicing engineers working in the area of manufacturing in general and laser-based manufacturing in particular.

The book comprises 22 chapters. First six chapters present the application of lasers for bending of metal sheets. The fundamentals of laser bending are discussed at length in these chapters. The research work carried out on numerical as well as experimental aspects is presented. In Chapters “[Surface Alloying of Aluminium with Copper Using CO<sub>2</sub> Laser](#)” and “[Effect of Pulsed Nd:YAG Laser Parameters in Preplaced TiC Coating on Aluminium Substrate](#),” the surface modification by laser processing is presented. Chapter “[Finite Element Simulation of Laser Cladding for Tool Steel Repair](#)” deals with finite element simulation of laser cladding for repair

of cutting tools. Chapters “[Excimer Laser Micromachining and Its Applications](#)” and next six chapters present laser-based advanced technologies developed for manufacturing of micro-sized features such as channels. The state of the art on the employment of various types of lasers, viz., Nd-YAG, Excimer for processing of advanced materials such as Ti-6Al-4V, zirconia, alumina, and PMMA are presented in the respective chapters. The application of laser for micro-drilling of SiC-30BN nanocomposite is presented in the Chapter “[Nd:YAG Laser Microdrilling of SiC-30BN Nanocomposite: Experimental Study and Process Optimization](#).” Chapter “[Pulsed Nd:Yag Laser Micro-Turning Process of Alumina Ceramics](#)” depicts experimental studies on Pulsed Nd:YAG laser micro-turning alumina ceramic. Chapter “[A Literature Review on CO<sub>2</sub> Laser Welding](#)” presents an overview of the recent trends in laser welding, while Chap. “[Fiber Laser Welding in a Controlled Inert Gas Atmosphere: An Experimental and Numerical Investigation](#)” presents numerical as well as experimental investigations on fiber laser welding. Chapter “[A 3-D Finite Element Analysis of Transient Temperature Profile of Laser Welded Ti-6Al-4V Alloy](#)” discusses the finite element method-based methodology of 3-D simulation of laser welding of Ti-6Al-4V alloy. Finally, Chap. “[Selective Laser Sintering: A Case Study of Tungsten Carbide and Cobalt Powder Sintering by Pulsed Nd:YAG Laser](#)” presents an important application of laser, i.e., sintering of tungsten carbide and cobalt powder using pulsed Nd:YAG Laser. Overall, the coverage is very wide, encompassing different manufacturing processes.

The authors and editors have taken utmost care in presenting the information and acknowledging the original sources wherever necessary. The editors express their gratitude toward the authors, organizers of AIMTDR, and staff of Springer (India) for making possible the publication of this research book. Readers are requested to provide their valuable feedback on the quality of the presentation and inadvertent errors or omission of information if any. We expect that the book will be welcomed by students as well as practising engineers/researchers.

Shrikrishna N. Joshi  
Uday Shanker Dixit

Lasers Based Manufacturing

5th International and 26th All India Manufacturing

Technology, Design and Research Conference, AIMTDR

2014

Joshi, S.N.; Dixit, U.S. (Eds.)

2015, XV, 464 p. 275 illus., Hardcover

ISBN: 978-81-322-2351-1