The use of lasers in materials processing, machining, diagnostics, and medical applications is a rapidly growing area of research. The main driving force behind this research is that lasers can provide unique solutions in materials processing, offer the ability to manufacture otherwise unattainable devices, and yield cost-effective solutions to complex manufacturing processes. In particular, recent advances in short-pulse and short-wavelength beams have stimulated research into laser precision microfabrication (LPM) in the fields of electronics, optoelectronics, micro- and nanomachining, new materials synthesis, and medical and biological applications.

In view of the impact of LPM, The Japan Laser Processing Society (JLPS) organized the inaugural International Symposium on Laser Precision Microfabrication (LPM 2000) in 2000 in Omiya, Saitama, Japan. The aim of this symposium was to provide a forum where leading experts, end users, and vendors can congregate to discuss both fundamental and practical aspects of LPM. It has grown in strength through successive conferences held annually in Singapore (2001), Osaka, Japan (2002), Munich, Germany (2003), Nara, Japan (2004), Williamsburg, USA (2005), Kyoto, Japan (2006), Vienna, Austria (2007), Quebec, Canada (2008), Kobe, Japan (2009), and Stuttgart, Germany (2010) and it is now recognized as one of the biggest and most important events in the field of laser microprocessing. The numbers of participants as well as papers presented continue to increase year by year due to expansion of the range of laser applications in both fundamental and practical research.

This book was primarily planned to introduce key papers presented at recent LPM symposia. However, we felt that its scope should be broadened to provide readers with more comprehensive information on the state of the art and future prospects of LPM. The book consists of 13 chapters covering a broad range of topics in LPM, introduced by internationally recognized experts in the field, most of whom are involved in the committee of the LPM symposia. It includes an overview of LPM (Chap. 1), theory and simulation (Chaps. 2 and 8), laser devices and optical systems for LPM (Chap. 3), fundamentals of laser–matter interaction (Chap. 4), beam shaping techniques (Chap. 5), biomedical applications (Chap. 6), nanotechnology (Chaps. 7 and 8), relevant processing techniques such as surface modification, micromachining, and laser-induced forward transfer (LIFT) (Chaps. 4, 9, and 10–12), and practical applications (Chap. 13).
We believe that this book offers a comprehensive review of LPM, which will be used not only by researchers and engineers already working in the field, but also by students and young scientists who plan to work in this area of research in the future. Last but not least, we would like to thank all of the chapter contributors for their great efforts and kind cooperation in editing this book.

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