

Transport in Laser Microfabrication

Emphasizing the fundamentals of transport phenomena, this book provides researchers and practitioners with the technical background they need to understand laser-induced microfabrication and materials processing at small scales. It clarifies the laser materials coupling mechanisms, and discusses the nanoscale confined laser interactions that constitute powerful tools for top-down nanomanufacturing. In addition to analyzing key and emerging applications for modern technology, with particular emphasis on electronics, advanced topics such as the use of lasers for nanoprocessing and nanomachining, the interaction with polymer materials, nanoparticles and clusters, and the processing of thin films are also covered.

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Transport in Laser Microfabrication: Fundamentals and Applications

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Costas P. Grigoropoulos

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To Mary, Vassiliki, and Alexandra

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Preface

Lasers are effective material-processing tools that offer distinct advantages, including choice of wavelength and pulse width to match the target material properties as well as one-step direct and locally confined structural modification. Understanding the evolution of the energy coupling with the target and the induced phase-change transformations is critical for improving the quality of micromachining and microprocessing. As current technology is pushed to ever smaller dimensions, lasers become a truly enabling solution, reducing thermomechanical damage and facilitating heterogeneous integration of components into functional devices. This is especially important in cases where conventional thermo-chemo-mechanical treatment processes are ineffective. Component microfabrication with basic dimensions in the few-microns range via laser irradiation has been implemented successfully in the industrial environment. Beyond this, there is an increasing need to advance the science and technology of laser processing to the nanoscale regime.

The book focuses on examining the transport mechanisms involved in the laser-material interactions in the context of microfabrication. The material was developed in the graduate course on *Laser Processing and Diagnostics I* introduced and taught in Berkeley over the years. The text aims at providing scientists, engineers, and graduate students with a comprehensive review of progress and the state of the art in the field by linking fundamental phenomena with modern applications.

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