

Preface

Over the past decades, laser microfabrication has successfully spread in micro-electronics, micromechanics, and some other areas. Nowadays, laser-induced microprocessing and, in some cases, nanoprocessing of materials constitute new and very promising application areas, such as MEMS, photonic, and fluidic devices, etc., for information, biomedical, and other technologies. In these areas, laser technologies are in the stage of transition from impressive demonstrations to practically feasible results for several reasons. First, short laser pulses of nano- and especially pico- and femtosecond duration, combined with modern focusing elements and beam scanning devices allow strong localization of laser pulse effects on the surface and in the bulk of materials. Second, the productivity of laser micro- and nanotechnologies is rapidly growing as a result of the development of reliable industrial lasers that emit intense radiation pulses with ultra-high repetition rate (up to the MHz range). The mean beam power of these lasers is now approaching the level of 1 kW and becomes comparable with that of lasers used for macro-processing of materials (welding, cutting, surface hardening, etc.).

Accordingly, various phenomena that can be induced by short intense pulses: surface and bulk modification of materials, radiation-induced chemical reactions, various types of ablation, plasma formation should be better understood for development of efficient and novel technological procedures.

Naturally, one book cannot cover all topics of interest in the field of laser micro- and nano-laser technologies. We have selected some of them—currently hot topics in our opinion—based on presentations made by a number of the world's leading experts who participated in the International Symposium, “Fundamentals of Laser-Assisted Micro- and Nanotechnologies” (FLAMN) recently. This is a serial and popular event that takes place every 3 years in St. Petersburg, Russia.

The book consists of 13 chapters divided into five parts:

- I. Laser-Matter interaction phenomena;
- II. Nanoparticles related technologies and problems;
- III. Surface and thin films phenomena and applications;
- IV. Bulk micro structuring of transparent materials;
- V. Laser-Induced modification of polymers.

We expect that the reader will be able to learn important features of (i) defect formation in laser-heated surface layers, (ii) laser ablation of organic and inorganic materials, (iii) metal oxidation by laser pulses, and (iv) reversible and irreversible changes of the structure and optical properties in the bulk of a material, induced by tightly focused ultrashort laser pulses. Special emphasis is made on the application of nanoparticles as a positive factor in materials processing. Several advanced applications of laser microtechnologies are included such as laser printing and laser fabrication of three-dimensional polymer devices.

We hope that the book will be of use for researchers and engineers, as well as for young scientists and students already working or planning to work in the area of laser applications. Finally, we wish to express our appreciation to all contributors for their friendly cooperation in preparing the book. Special thanks to Dr. Koji Sugioka to whom the idea to publish this book belongs.

St. Petersburg
Moscow

Vadim P. Veiko
Vitaly I. Konov

Fundamentals of Laser-Assisted Micro- and
Nanotechnologies

Veiko, V.p.; Konov, V.I. (Eds.)

2014, XVII, 322 p. 145 illus., 49 illus. in color.,

Hardcover

ISBN: 978-3-319-05986-0