

Preface

This book outlines “nanophotonic” fabrication, a subject in which the author was engaged for 15 years. The author joined this field in the mid-1990s, and the idea of nanophotonics was proposed by Professor Ohtsu in 1993. The optical near-field was used as a light source for high-resolution microscopy beyond the diffraction limit of light. With the highly reproducible fabrication technique of fiber probes, the near-field microscopy can obtain optical images on the scale of a single nanometer in spatial resolution. Further progress was achieved by developing high-throughput optical fiber probes. Thus, the optical near-field can be applied to optical fabrication, including ultra-high-density optical memory, photolithography, and single-nanometer-scale photochemical vapor deposition (PCVD).

In addition to the advantage of exceeding the diffraction limit of light using the optical near-field (i.e., quantitative innovation), this achievement demonstrated that exceeding the diffraction limit of light is not essential but is simply a secondary aspect of nanophotonics. The fundamental feature “nanophotonics” is the novel functions and phenomena and originate from the intrinsic optical near-field interaction. The optical near-field interaction uses a virtual photon and can therefore be localized on the nanoscale. Additionally, the virtual photon interaction can utilize optically “inactive” states, including multiple phonon states in a material. These features of nanophotonics represent a qualitative innovation in optical science and technology because they could not be realized using conventional propagating light.

This book focuses on “nanophotonic” fabrication. With the qualitative innovation of nanophotonics, optical fabrication can be achieved on the subnanometer scale. Although there are some nanoscale fabrication techniques that use top-down lithography, it is not clear whether the fabricated structures are functional. Because the size of the fabricated devices is on the nanoscale, they are operated by the optical near-field. Thus, by using the optical near-field during fabrication, a structure is fabricated automatically so that it exhibits the best performance, i.e., the nanophotonic fabrication gives rise to new functions in the fabricated structure. The author intends for this book to be an introduction for readers, who will be interested in various functions that differ depending on the device.

The author wishes to express special thanks to Dr. M. Ohtsu, Editor of the Springer Series in Optical Sciences, and Professor at The University of Tokyo for recommending this publication. He also thanks Drs. T. Kawazoe, W. Nomura, K. Kitamura, and N. Tate (The University of Tokyo); Dr. M. Naruse (National Institute of Information and Communications Technology); Professors I. Banno, K. Kobayashi, and H. Hori (Yamanashi University); Professors M. Sugiyama, H. Fujita, and M. Washizu (The University of Tokyo); Professor M. Yoshimoto (Tokyo Institute of Technology); Professor G.-C. Yi (Seoul National University), Mr. K. Hirata, Dr. T. Morimoto, and Mr. Y. Tabata (SIGMA KOKI Co., Ltd.), Dr. Y. Yanase, Mrs. K. Suzuki, M. Fujita, A. Kamata (Covalent Materials Corporation); Mrs. K. Ito and H. Kawamura (Nitto Optical Co., Ltd.); Dr. M. Mizumura (V-Technology Co., Ltd.); and graduate students of Professor Ohtsu's research group for their active support and discussions. This work was partially supported by the New Energy and Industrial Technology Development Organization (NEDO) and Japan Society for the Promotion of Science(JSPS). Finally, Dr. Claus Ascheron of Springer-Verlag is acknowledged for his guidance and suggestions.

Tokyo

Takashi Yatsui



<http://www.springer.com/978-3-642-24171-0>

Nanophotonic Fabrication
Self-Assembly and Deposition Techniques

Yatsui, T.

2012, VIII, 124 p., Hardcover

ISBN: 978-3-642-24171-0