Microlithography

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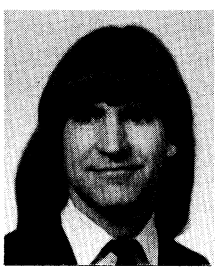
This special section of *Optical Engineering* focuses on the science and technology covered by SPIE's annual conferences in San Jose, California, devoted to microlithography. There are currently four symposia: Optical/Laser Microlithography; Advances in Resist Technology; Integrated Circuit Metrology, Inspection, and Process Control; and Electron-Beam, X-Ray, and Ion-Beam Submicrometer Lithographies for Manufacturing. These cover a broad range of topics including materials, hardware, and processing. The selection of papers published here was influenced significantly by my own areas of knowledge and interest, which led me to twist the arms of a particular subset of the authors whose work is prominent in this community. I believe, however, that this selection gives an accurate and timely view of the state of the fields of resist synthesis and processing and microlithographic optical systems. Eight of the papers are based on presentations in the 1993 symposia, two in the 1992 symposia, and one is in part a review of three contributions to earlier symposia between 1988 and 1992, as well as new material. The remaining six papers have not been published elsewhere.

The section on optics and optical systems (four papers) reflects the intense interest in the use of phase information for increasing the effective resolution of current optical cameras, along with the critical importance of alignment and focus systems for achieving a practically meaningful resolution. The two papers on resist composition represent two of the key activities in this area: chemical amplification (for greater sensitivity and versatility in design) and design for EUV wavelengths. The third area, the incorporation of silicon or other oxygen-plasma-etch resistant elements into resists, is well covered by the four processing papers. The application of lasers and laser-based processing to microlithography is described in four papers, which include a description of a holographic aligner, a review of the current design and performance of excimer laser systems, and the remarkable features attainable from nonlinear laser chemistry. Finally, x-ray and electron-beam lithography are covered in three papers; an entirely new surface-imaging resist process is reported for the former, and methods (based on electron optics, computation, and processing) of addressing the loss of feature size control due to backscattered electrons are described for the latter. In total, these papers show the close intertwining of chemistry, physics, and processing in the practical application of an optically based technology and emphasize the value of an interdisciplinary effort in solving these problems.

It is my pleasure to thank Brian Thompson for inviting me to organize this special issue, and I wish to express my gratitude to the authors and especially to the reviewers who in many cases were willing to review papers on extremely short notice; their effort has contributed greatly to the timeliness of this collection.



James R. Sheats received his BS in chemistry from Colorado State University in 1974 and the PhD in physical chemistry from Stanford University in 1979. After performing postdoctoral work at Massachusetts Institute of Technology and Stanford University, he joined Hewlett Packard Laboratories in 1982 where he worked in the Advanced Optical Lithography Group. In 1988 he moved to the Superconductivity Department, and since 1992 he has been with the Solid State Materials Department. His research activities during this time have been in the areas of synthetic organic chemistry, biophysical chemistry, polymer photochemistry, thin film microfabrication, scanning probe microscopy, and electroactive polymers. His current interests are in the application of polymers to electronics, photonics, and sensors and the synthetic and physical chemistry of surfaces, thin films, microstructures, and nanostructures. He is the author of 31 papers and three patents. Dr. Sheats is a member of the APS, ACS, AAAS, and SPIE.