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Preface

The concept of the Institutes for Advanced Optical Technologies developed out of SPIE's desire to foster increased interaction and collaboration among researchers working in emerging optical technologies. The Institutes provide a forum for experts in these areas to analyze and document the state of the art and to point toward future trends and applications. Institute topics are selected for their timeliness as well as for their significance to future progress in the application of optics. Institute organizers invite selected experts to participate as paper contributors and discussion participants. It is intended that the interaction generated by the small-group structure in a retreatlike setting will foster productive discussions that are beyond the scope and possibility of a regular conference format.

Each Institute has two primary objectives: first, that the interactions and dialogue stimulate technical advancement, and second, that the publication of the Institute volume results in an authoritative collection of significant papers covering key topics in the field. While each editor and committee has unique criteria for determining the acceptability of contributions, it is intended that the Institute process itself will establish the worth and appropriateness of the individual contributions. Each contributor is asked to prepare a draft manuscript and circulate it to the other participants in advance of the Institute. The editor/chair organizes an agenda for discussing critical technical issues. The interactions and collegial discussions by the Institute members are the basis for the ensuing Institute volume. The final action of the Institute is to decide the scope of the volume and what material is to be included and what other material is to be added and by whom.

The Institute on Large-Area Chromogenics: Materials and Devices for Transmittance Control, held in Hamburg, Federal Republic of Germany, September 22-24, 1988, addressed technical issues for this emerging technology and the future impacts it might have on society. The interactions and discussions were lively, at times warm, and gave the participants a more comprehensive grasp of the subject. The resultant volume is this authoritative Institute publication emphasizing topics such as photochromic materials, organic and inorganic electrochromic materials, electrochromic devices, and liquid-crystal materials and devices.

Roy F. Potter
General Editor, SPIE Institute for Advanced Optical Technologies

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Other publications in the *SPIE Institutes for Advanced Optical Technologies* series:

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Photonics: High Bandwidth Analog Applications, James Chang, Editor, 1987, SPIE Volume 648

Dosimetry of Laser Radiation in Medicine and Biology, Gerhard J. Müller, David H. Sliney, Editors, 1989, Volume IS 5

Photodynamic Therapy, Charles J. Gomer, Editor, Volume IS 6
(To be published Fall 1990)

Automatic Object Recognition, Hatem Nasr, Editor, Volume IS 7
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Introduction

Chromogenic materials can alter their optical properties in a persistent yet reversible manner when subjected to a change in external conditions such as irradiation intensity, temperature, or electric-field strength. The most well-known chromogenic devices are probably photochromic sunglasses, which color in the sun and bleach in the dark. In the future, chromogenic materials may be used on a large scale to regulate the throughput of radiant energy for windows in buildings and cars, so that comfortable lighting and temperature are maintained without excessive air conditioning. Chromogenic materials can also be used in variable reflectance mirrors, in displays (such as road signs), and so forth. Traditionally, chromogenics has not been viewed as a self-contained subject for study. However, for some years it has been the opinion of the editors of this book that the time has come for a change, and that both the interrelations between the different materials enabling variable optical properties and the similarities between their potential applications warrant a unified approach to chromogenics. This is the first book on the subject. Many people have contributed, which in itself is a manifestation of the fact that the importance of chromogenic studies is becoming widely recognized.

The first idea that a book should be written on large-area chromogenics—even though the term had not yet been coined—materialized in June 1985. Concrete plans for such a book were made in 1988, when we approached the newly begun Optical Engineering Press. We asked a number of hand-picked researchers to contribute chapters on various aspects on chromogenics for the book, which was met with enthusiasm. The decisive days for this book were 22–24 September 1988—immediately following a topical conference in Hamburg, Germany, on Optical Materials Technology for Energy Efficiency and Solar Energy Utilization—when many of the contributors met in a quiet German hotel. Those were days filled with scientific discussions and culinary extravagances in an atmosphere that was inspiring indeed. Without exception, we seemed to be filled with zeal and a feeling that we were about to embark on a project of lasting importance.

The ambitious goal of this book is to give a broad coverage of all aspects of chromogenics. This is of course impossible to accomplish, and whether we have come close or not is up to the reader to judge. We are aware of some unfortunate omissions in the text, the most apparent perhaps being the lack of a detailed discussion of polaron absorption in amorphous electrochromic materials. Further, we are concerned that some relevant research conducted in Eastern Europe and certain Third World countries has not been given due consideration.

During the completion of this book we were informed of the death (22 February 1989) of one of the contributors, Professor Jesse H. Day of Ohio University, Athens, Ohio. His contribution to this book, we regret to say, is his last scientific paper. We are grateful to Professor Roger Willett of Washington State University, Pullman, Washington, who rewrote and expanded Professor Day's original draft chapter.

We wish to thank all of you who contributed for your kind cooperation and unfailing support, and for lessening the editors' burden by submitting your papers promptly. Without all of your efforts, this book would not exist. Special thanks go to Roy Potter of SPIE, who inspired and supported us from the beginning of this project. To all others who have helped us to bring this book to completion, we owe our deepest appreciation.

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