Infrared Fiber Optics

Paul Klocek
Texas Instruments Incorporated

George H. Sigel, Jr.
Rutgers University

Roy F. Potter, Series Editor
Western Washington University

TUTORIAL TEXTS IN OPTICAL ENGINEERING

Volume TT 2

SPIE OPTICAL ENGINEERING PRESS
A Publication of SPIE—The International Society for Optical Engineering
Bellingham, Washington USA

Library of Congress Cataloging-in-Publication Data

Klocek, Paul.
Infrared Fiber Optics.

(Tutorial texts in optical engineering ; v. TT 2)
Includes bibliographical references.
1. Fiber optics. 2. Infrared technology. I. Sigel, George H., 1940- II. Title. III. Series.
TA1800.K56 1989 621.36'92 89-10781
ISBN 0-8194-0229-X

Published by
SPIE—The International Society for Optical Engineering
P.O. Box 10
Bellingham, Washington 98227-0010

Third Printing

Printed in the United States of America

Foreword

Tutor: to teach or guide, usually individually, in a specific subject

The aim of the Tutorial Texts series is to fulfill the essential role of a tutor for selected topics in optical science and engineering. The Tutorial Texts are based on the SPIE short course program. The attendance and the evaluations of those attending a course provide a measure of the degree of interest in the subject matter as well as a qualitative statement about the potential of the course curriculum and lecture notes developing into a book.

This new series has been undertaken with much enthusiasm on the part of the SPIE Optical Engineering Press. These volumes reflect the excitement of working with our short course instructors to translate a series of lecture notes into stand-alone texts of a tutorial nature. Indeed, the Tutorial Texts are intended to accomplish, in book format, what the instructor/author does in the course environment. The scope, content, and presentation level are essentially the same in course and book.

This Tutorial Text on Infrared Fiber Optics provides the reader with a current view of the field of infrared fibers along with tutorial material for understanding the possibilities for future applications.

Roy F. Potter
Western Washington University
1 August 1989

TABLE OF CONTENTS

TABLE OF CONTENTS (CONTINUED)

LIST OF ILLUSTRATIONS

LIST OF ILLUSTRATIONS (CONTINUED)

LIST OF ILLUSTRATIONS (CONTINUED)

LIST OF TABLES

Preface

We first taught the SPIE short course from which this book is adapted in May 1984. We agreed to teach the course for two reasons: first, to explain and demonstrate the potential of IR fiber technology and to encourage its application, and second, because it afforded us the opportunity to pull together and review the many different infrared fiber optic technologies.

Due to the diversity of applications and the many different IR fiber technologies under development, this Tutorial Text necessarily covers a lot of material. A general review of the fundamental principles of propagation, attenuation, and dispersion as they relate to dielectric and hollow waveguides made of oxide, halide, or chalcogenide glasses and metals is the starting point. This is intended to allow the reader to move through the chapters on each fiber technology and its applications recognizing its advantages, disadvantages, the relative state of the art, and its future potential. The book moves from the fundamentals through materials, fabrication, physical properties, and finally applications.

As an adaptation from a short course, the book gives a complete overview of the entire field but often with brevity. The general level of the book is intended to allow someone new to the field to gain a useful insight, as well as someone established in the field to have access to a comprehensive review of the different IR fiber optic technologies.

Acknowledgments

The authors would like to acknowledge the financial support of Texas Instruments Incorporated for the manuscript preparation, the Technical Publications Department of Texas Instruments for preparing the manuscript, Gloria Beduhn for editorial support, Dr. James M. Florence for technical assistance, and Annette Woktowicz for general assistance.

Paul Klocek
Texas Instruments Incorporated

August 1989

George H. Sigel, Jr.
Rutgers University