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Shin-ichi Todoroki

# Fiber Fuse

Light-Induced Continuous Breakdown  
of Silica Glass Optical Fiber

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# Preface

This monograph deals with experimental aspects of the fiber fuse phenomenon. My research began 17 years after this phenomenon was discovered. At that time, it had begun to attract attention as a serious problem for the optical communication industry (see Fig. 1.2). Although my research results using an ultrahigh-speed camera provided us with new findings about this moving luminous object, I could not help feeling that more experimental facts were needed if we were to extract the underlying mechanism explaining this seemingly strange behavior. Since then, I have collected many photographs showing fiber fuse damage, and this collection has convinced me that the behavior is no longer strange.

This monograph starts with a chapter reviewing silica glass optical fibers and the fiber fuse phenomenon and continues with three subsequent chapters exploring the fiber fuse behavior in typical single mode fibers step-by-step. To assist the reader, 12 links to online video clips are provided in the text (see Box 0.1 in the next section as an example). The last chapter concludes the discussion from a practical point of view to encourage further research.

I hope you enjoy the process of solving this riddle and discover the beauty of the track left by a tiny comet running through a silica glass fiber.

Tokyo, January 2014

Shin-ichi Todoroki

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**Box 0.1** Portal site for fiber fuse research

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- A full list of fiber fuse research papers and related information are available. Supplementary information related to this book can be found here.



<http://fiberfuse.info>

Moderator: S. Todoroki

Establishment: Feb. 8th, 2013



QR code of the above URL  $\Rightarrow$

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# Contents

<b>1 Silica Glass Optical Fiber and Fiber Fuse</b> . . . . .	1
1.1 Introduction . . . . .	1
1.2 Silica Glass Optical Fibers . . . . .	3
1.3 Fiber Fuse Propagation and Damage Left Behind . . . . .	6
1.4 Safeguard Technologies . . . . .	9
1.5 Conclusion . . . . .	12
References . . . . .	12
<b>2 Fiber Fuse Propagation Modes</b> . . . . .	17
2.1 Introduction . . . . .	17
2.2 In Situ Observation of Fiber Fuse Propagation . . . . .	18
2.3 Void Track Variation with Pump Power . . . . .	20
2.4 Precise Measurement of Propagation Speed . . . . .	22
2.5 Summary . . . . .	24
References . . . . .	24
<b>3 Periodic Void Formation</b> . . . . .	25
3.1 Introduction . . . . .	25
3.2 Void Formation Process in Cylindrical Mode . . . . .	25
3.3 Cladding Mode Self-pumping of Confined Plasma . . . . .	29
3.4 Periodic Void Formation in Unstable Mode . . . . .	32
3.5 Summary . . . . .	34
References . . . . .	34
<b>4 Delayed Response of Silica Melt to Pump Modulation</b> . . . . .	37
4.1 Introduction . . . . .	37
4.2 Self-pumping Modulation . . . . .	38
4.3 Pump Power Modulation . . . . .	38
4.4 Waveguide Modulation . . . . .	43
4.5 Summary . . . . .	47
References . . . . .	47



<b>5 Conclusion</b> . . . . .	49
<b>Appendix A: Comparison with Bulk Silica Glass Modification by Continuous-Wave Laser</b> . . . . .	51
<b>Appendix B: Fiber Fuse in Materials Other than Silica Glass</b> . . . . .	53
<b>Index</b> . . . . .	57

# Acronyms

- DSF Dispersion-Shifted Fiber, an optical fiber whose dispersion is designed to be zero at 1,550 nm (the minimum-loss window of silica glass fibers).
- FMF Few Mode Fiber, an optical fiber designed to carry few (more than one) light wave modes.
- HAF Hole-Assisted Fiber, an optical fiber whose core is surrounded by a number of holes. See Fig. 1.10 (b-1).
- MFD Mode Field Diameter, a structural parameter of single-mode fibers, namely the diameter at which the light intensity is  $1/e^2$  of the maximum value.
- NZDSF Nonzero Dispersion-Shifted Fiber, an optical fiber whose dispersion is designed to be negative at 1,550 nm.
- SMF Single Mode Fiber, an optical fiber designed to carry only one light wave mode.