Refractive index engineering in silica glass

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Publication date:
2003

Document Version
Publisher's PDF, also known as Version of record

Refractive Index Engineering in Silica Glass
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Portrait: Lasse Rusborg
Prepress: Heidi Koch
Printed in Denmark 2003
by Levison + Johnsen + Johnsen A/S, Glostrup

ISBN 87-90974-41-7

The refractive index of glass can be changed by exposure to ultraviolet light or strong electrical fields. This doctoral thesis summarises research on different methods to change the refractive index. The main subjects are processes induced by ultraviolet light in germanium-doped glass, the application of refractive index changes within components for telecommunications, and the development of high-voltage treatment (poling) as a method to fabricate non-linear glass.

The thesis presents a model for ultraviolet-induced refractive index changes. The model assumes that refractive index changes take place when ultraviolet light is absorbed at germanium-sites and transferred through non-radiative processes to other places in the glass where defects are formed. This describes a wide range of the phenomena observed in germanium-doped glass. The model presentation is followed by a summary on the application of the refractive index changes for fabrication of components such as Bragg grating filters and lasers.

The last section concerns poling. Strong electrical fields at elevated temperatures perform poling of the glass. The aim is to obtain a non-linear refractive index in the glass. Potential applications of non-linear glass include wavelength conversion (e.g. turning red light into blue) and electro-optic switching.

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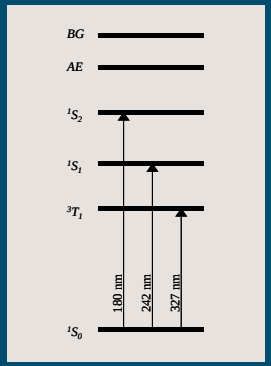

Martin Kristensen

Martin Kristensen received the M.Sc. and Ph.D. degrees from Aarhus University, Denmark in 1989 and 1992 within the subjects of molecular physics, and laser cooling and spectroscopy. From 1992 to 1994 he was at the Huygens Laboratorium in Leiden, The Netherlands, performing research on quantum optics.

From 1994 to 1998 he was group leader within photonics at Mikroelektronik Centret, Technical University of Denmark (DTU), where he was performing research and development of integrated optics and Bragg gratings. In January 1999 his group was transferred to the newly established COM Center at DTU. April 1, 2000 he was appointed Professor at COM, where he is heading the Gratings and Poling group in the glass competence area. In addition to Bragg gratings and glass poling he and his group are performing research on planar photonic bandgap components.

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