Attenuation in silica-based optical fibers

In this thesis on attenuation in silica-based optical fibers results within three main topics are reported. Spectral attenuation measurements on transmission fibers are performed in the wide wavelength range 290 nm – 1700 nm. The measured spectral attenuation is analyzed with special emphasis on absorption peaks in order to investigate the cause of an unusual high attenuation in a series of transmission fibers. Strong indications point to Ni2+ in octahedral coordination as being the cause of the high attenuation. The attenuation of fibers having a high core refractive index is analyzed and the cause of the high attenuation measured in such fibers is described as being due to scattering of light on fluctuations of the core diameter. A novel semi-empirical model for predicting the attenuation of high index fibers is presented. The model is shown to be able to predict the attenuation of high index fibers having viscosity profiles similar to those for which the model was calibrated but not of fibers having dissimilar viscosity profiles. The model is improved by including the viscosity profiles of the fibers. A set of fibers is produced demonstrating that by carefully designing the index profile as well as the viscosity profile a lower attenuation of high index fibers can be obtained. The design of dispersion compensating fibers using the super mode approach is described, the object being to design dispersion compensating fibers for dispersion compensating fiber modules having a low attenuation, described by a high figure of merit. The major trade-offs encountered when designing dispersion compensating fibers with high figure of merit are to obtain a very negative dispersion, low attenuation and low micro-bend loss at the same time. The model for predicting the attenuation of high index fibers is used for the optimization process and results are reported of a dispersion compensating fiber having a record high figure of merit of 470 ps/(nm dB).

General information
State: Published
Organisations: Department of Photonics Engineering, Fibers & Nonlinear Optics
Contributors: Wandel, M. E., Rottwitt, K., Povlsen, J. H.
Number of pages: 91
Publication date: Mar 2006

Publication information
ISBN (Print): 978-87-90974-91-6
Original language: English
Electronic versions:
Marie_Wandel_PhD_fina051204l.pdf
Source: orbit
Source-ID: 205783
Research output: Research › Ph.D. thesis – Annual report year: 2006