Faculty of Electrical Engineering & Computer Science
Master Degree Course Electronics Engineering, MSc EE

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Characterization of Optical and Material Properties of a Polysulfone Based Polymer Optical Fiber.

ABSTRACT - Masterthesis

For this Master thesis two different types of optical waveguides were characterized and compared. One of the waveguides was made in the 'Faserinstitut Bremen e.V.'. This fiber was made out of Polysulfone and Polyethersulfone. The second waveguide was a CYTOP (cyclic transparent optical polymer) fiber which was bought. The glass transition temperature of the polysulfone fibers was determined with differential scanning calorimetry (DSC) and thermo mechanical analysis (TMA). Both methods delivered the same results of about 188° C. This temperature is within a 10% deviation of the datasheet values of polysulfone. The glass transition temperature of the CYTOP fibers was determined with TMA only. The measured glass transition temperature was 88° C.

The numerical aperture of the CYTOP fiber was measured. The results were close to the datasheet values of NA=0.185.

The polysulfone fibers had non-standard diameters which lead to incompatibility with standard connectors and measuring devices. The fibers had a total diameter of 100 µm and a core diameter of 40 µm. For this a method of fixating the fibers in glass tubes with ultra violet setting glue and following polishing steps were used, this lead to reliable surface preparation of the fibers. The attenuation measurements with the polysulfone fibers showed that the core of the fibers doesn't guide waves as well as the cladding material.

The inability of the polysulfone fibers to guide light over long distances through the core should be investigated further. The cladding material has a lower transparency than the core material. Due to the fact that the cladding could guide light over several centimeters and the core couldn't, leads to the assumption that the transparency is not the reason for that. Changing diameters of the core, micro fractures and impurities in the material are unlikely to happen due to the manufacturing process itself.