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TECHNICAL REPORT

Guidance for residual stress measurement of optical fibre



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GUIDANCE FOR RESIDUAL STRESS MEASUREMENT OF OPTICAL FIBRE

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IEC/TR 62469, which is a technical report, has been prepared by subcommittee 86A: Fibres and cables, of IEC technical committee 86: Fibre optics.

The text of this technical report is based on the following documents:

Enquiry draft	Report on voting
86A/1143/DTR	86A/1148/RVC

Full information on the voting for the approval of this technical report can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
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- amended.

A bilingual version of this publication may be issued at a later date.

GUIDANCE FOR RESIDUAL STRESS MEASUREMENT OF OPTICAL FIBRE

1 Scope

The measurement of residual stress distribution in an uncoated glass optical fibre is considered to be important as it affects critical fibre parameters such as refractive index, intrinsic polarization mode dispersion, mode field diameter and dispersion. The optical polarimetric method is a well-established technique to measure the residual stress of an optical material. This technical report describes a transverse polarimetric method to measure the residual stress profile of any type of optical fibre.

The principle and detailed procedure for measuring the optical transverse stress profile of a fibre, which is cylindrically symmetric, is described in detail. It is based on a polariscope, which is constructed with a fixed polarizer, a quarter-wave plate and an analyzer. An optical tomographic technique is also described for measuring the stress profile of a fibre with a cylindrically non-symmetric structure.

2 Justification of measurement

Residual stress in an optical fibre is induced by the combination of the fibre construction and the drawing process. The stress information is important because it affects many important parameters of an optical fibre due to the following reasons.

- Temperature dependent changes of fibre parameters are larger for a fibre with larger residual stress, and these are responsible for the statistical behaviour of polarization mode dispersion (PMD) changes in deployed fibre links. (See references [10-12].)[1)]
- The variation of important fibre parameters such as chromatic dispersion, mode field diameter, PMD depends on the intrinsic residual stress of an optical fibre. (See references [13-17].)
- The asymmetric residual stress profile of a fibre causes fibre curl, which affects cleaving quality for an optical fibre ribbon.
- The asymmetric residual stress of a fibre is a major cause of the intrinsic PMD of an optical fibre. (See references [18-20].)
- Excessive residual stress can lead to core cracking that might be seen in, for example, the preparation of the ends for connectors.
- The design of polarization retaining fibres normally involves inducing a non-symmetric stress field. This measurement can be used to confirm these designs.

Much progress has been made in measuring the residual stress profile of an optical fibre (see references [1-9]) such that spatial resolution can be as small as 0,6 μ and accuracy in measuring stress can be as low as 0,4 MPa.

Depending on the application, either one- or two-dimensional stress data may be needed. This document describes methods by measuring the polarization rotation of a transversely exposed laser light across a fibre cross-section using a polarimetric method.

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1) Figures in square brackets refer to the Bibliography.