CFEL SCIENCE

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Interferometric separation of absorption striae and refractive index striae in optical materials

The spatial homogeneity of the glass is a key factor for optical systems and still is a challenge for glass scientists and technologists. The lack of homogeneity in a glass is characterized by the occurrence of layers of different chemical compositions and densities called chemical striae. Chemical striae in all optical elements are undesirable because they blur the image and decrease its contrast by refracting light rays to undesirable positions in the image plane.

Different existing technique offer the possibility to characterize these striae. We can cite shadowgragh [1], electron microprobe [2], image processing, Christiansen filter or typical interferometric microscopy. However until now none of these methods was being able to distinguish between the striae caused by the variation in optical absorption and the striae due to the refractive index deviations.

The main goal of this work is to establish a technique using a low coherence interferometer to separate the origin of striae. The knowledge of the origin allows the optimization of the optical glass production technology. The expected contrast of the refractive index is between 10^{-1} and 10^{-6}.

The principle of this experiment is based on the optical path difference measurements and the intensity of the observed interference patterns being assembled by the reflected and transmitted light through the sample.

[1] T. T. Smith, A. H. Bennett, and G. E. Merritt, "Characteristics of striae in optical glass," *Bull. Bur. Stand*. (U.S.) **16**, 75–91 (1920)

[2] L. Wondraczek, H. Behrens, Y. Z. Yue, J. Deubener, and G. W. Scherer, “Relaxation and Glass Transition in Isostatically Compressed Diopside Glass,” *J. Am. Ceram. Soc.* **90** 1556-1561 (2007)

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