Long-term strain response of polymer optical fiber FBG sensors

We report on the viscoelastic response of PMMA microstructured polymer optical fibers (mPOFs) when exposed to long periods of strain and relaxation, with the strain period ranging from 0.5 min to 50 min. The behavior of the fibers was monitored by inscribing a fiber Bragg grating (FBG) in them and tracking the reflection peak. We demonstrate that the fiber, when relaxing from strains of up to 0.9%, has a two-phase recovery: initially linear (elastic driven) and subsequently nonlinear (viscoelastic driven) contraction. The linear (elastic) relaxation wavelength range depends both on the strain level and on the strain duration. For short strain durations, this wavelength range stays the same, but with increasing strain duration, it decreases, which will influence the operation range of mPOF and POF-based FBG sensors.

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