Polymer optical fiber Bragg grating inscription with a single UV laser pulse

We experimentally demonstrate the first polymer optical fiber Bragg grating inscribed with only one krypton fluoride laser pulse. The device has been recorded in a single-mode poly(methyl methacrylate) optical fiber, with a core doped with benzyl dimethyl ketal for photosensitivity enhancement. One laser pulse with a duration of 15 ns, which provide energy density of 974 mJ/cm², is adequate to introduce a refractive index change of 0.74×10⁻⁴ in the fiber core. After the exposure, the reflectivity of the grating increases for a few minutes following a second order exponential saturation. The produced Bragg grating structure rejects 17.9 dB transmitted power, thus providing 98.4% reflectivity, which is well suited for sensing applications. In addition, we report the importance of the fiber thermal treatment before or after the inscription, showing its effects on the lifetime and quality of the grating structures. Optimizing the irradiation conditions and the material chemical composition, a higher refractive index change in the fiber core is feasible. This demonstration significantly improves the potential for commercial exploitation of the technology.