Multi-scale pattern with surface quasi crystal for wettability tuning

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Self-**reconstructing** nonlinear effects in p**olymer** f**ibers**

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Abstract: New all-optical poling (AOP) experiments conducted in multi-core dye-doped poly(methyl methacrylate) optical fibers show that self-sustained and faster rise time second harmonic generation is possible in polymers.
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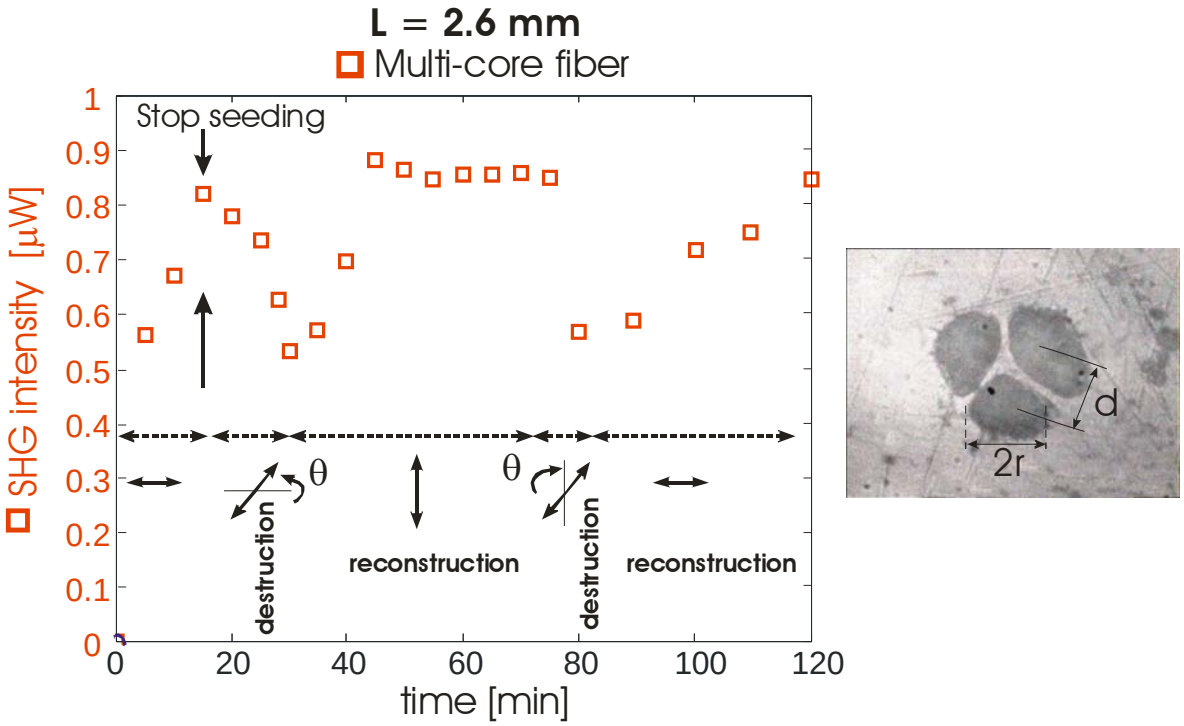
The possibility to convert by light the nature of a transparent material and to reveal its nonlinear optical properties is always challenging [1]. Second-order nonlinear effects are forbidden in centrosymmetric materials. However a pump beam with a simultaneous seeding light at double frequency has revealed the possibility of inducing a second-order nonlinear optical susceptibility $\chi^{(2)}$ by light [2].

The origin of the effect was found in an orientational hole burning. All-optical poling (AOP) has been developed as a self-induced second harmonic generation process. Despite a huge activity dedicated to the study of AOP in polymer materials, the stable induction of a second harmonic (SH) signal was never conclusively demonstrated [3]. The reason explaining this result is that the light inducing the second harmonic response can destroy it.

A long-term stability of the second harmonic generation (SHG) photoinduced in different types of fibers (single core or multi-core) can be induced. After destroying the photoinduced SHG by rotating the polarization of the fundamental laser beam, the photoinduced SHG can grow again till its initial value or above. This gives the evidence that self-sustained SHG is achieved in polymers optical fibers.
The AOP process consists in two alternated periods: the writing phase where the fundamental laser beam is sent together with the SH seeding beam; and the readout phase where only the fundamental laser beam is sent to probe the SHG.

When the seeding beam is stopped measurements shows the self-sustain of the SHG. In order to ensure the self-reconstructing SHG, the simplest idea was to destroy the all-optical polling organization and let it be reconstructed without the assistance from the SH-seed beam. To do so, the polarization of the reading IR was turned. The SHG almost vanished in longer fibers, before reconstruction. This experiment has revealed the efficiency of SHG self-reconstruction in plastic optical fibers. Dye-doped single and multi-core PMMA optical fibers demonstrate efficient optical fiber component for SHG. Single-core or multi-core fibers show self-sustained SHG. Most importantly, SHG grows back to its initial value or above after destruction of the polar order [4].



Evolution of the self-reconstructing SHG upon rotation of the reading beam polarization at 1300 nm. Initial polarization was set *s* (horizontal) during the seeding process, as indicated by an horizontal arrow. Rotation of the half-wave plate in front of the IR reading beam was carried by increments of 10° every 5 min.

References

References should appear at the end of the paper in the order in which they are referenced in the body of the paper. The font should be 8 point, and the references should be aligned left.

Within the main text, references should be designated by a number in brackets [1], and they should be followed by a comma or period [2]. Two references cited at once should be included together [3,4], separated by a comma, while three or more consecutive references should be indicated by the bounding numbers and a dash [1–4].

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