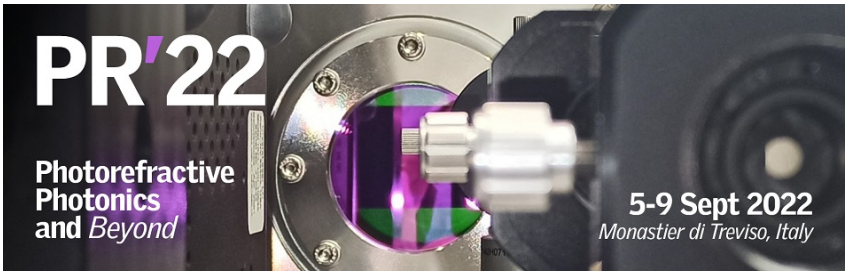

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Polarization dependent second-harmonic generation in cascaded optically poled fibers

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Commercial Ge-doped silica fibers can be converted into frequency doublers, despite the lack of quadratic nonlinearity of the glass, by employing optical poling. With this technique, injecting high-intensity fundamental frequency pulses into the fiber generates photoinduced currents leading to a static electric field resulting in an effective second-order nonlinearity that satisfies the quasi-phase-matching condition. For instance, a poled 1 m long Ge-doped fiber can generate the second-harmonic (SH) of 1064 nm pulses with an average conversion efficiency of about 1%. However, the conversion efficiency is limited by the difficulty of preserving the polarization of the fundamental light used during the poling process over the entire fiber length. Also, a limitation comes from the short extent of the poled region obtained by the optical poling, which is typically around 60 cm, regardless of the actual length of the fiber undergoing the poling process. Our experimental work demonstrates that these limitations can be partially overcome by resorting to a circularly polarized fundamental field to independently pole a number of fiber sections and then by cascading poled fiber segments. The segments can be cascaded either by splicing using a fusion splicer or by connectorizing the fibers and then mating the connectors. Although the SH power is a quadratic function of the propagation distance within a single segment, we observed that the SH obtained by cascading a small number of segments (up to 5) grows approximately linearly with their number.

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