XXXII Panhellenic Conference on Solid State Physics and Materials Science
Conference Center "Carolos Papoulias", 18-21 September 2016, Ioannina, Greece

Silica nanowires with a highly nonlinear glass thin coating for flat extra-wide supercontinuum generation

Grigoris Antonopoulos[1], Christos Riziotis[1], George Kakarantzas[1]
[1]*Theoretical and Physical Chemistry Institute, National Hellenic Research Foundation, Vassileos Konstantinou Avenue, 11635, Athens, Greece*

Abstract: We report on the fabrication of hybrid photonic nanowires consisting of silica tapered fibers covered with a thin layer (< 100 nm) of a highly nonlinear sol-gel glass (HNG). These hybrid nanowires exhibit finely tunable waveguide properties: The positioning of a single layer of high index glass around the silica taper is found to be sufficient for obtaining zero-dispersion wavelengths at any point throughout the visible and near-infrared, and both positions and values of dispersion maxima can be adjusted according to design. It is, thus, possible to fine-tune the waveguide properties of the nanowires only by slightly adjusting, for example, the thickness of the HNG layer, while the silica taper diameter is kept constant.
The high-nonlinearity due to strong confinement and the tunability of the GVD make these hybrid nanowires extremely attractive and versatile candidates for different nonlinear applications, such as pulse compression and supercontinuum generation [1, 2]. Indeed, a 1-μm-diameter silica fiber coated with a 95-nm-thick HNG coating (n = 1.81) has been numerically shown to generate a flat, octave spanning, mid-infrared supercontinuum, far wider than what would have been possible with uncoated silica tapers [3].
The hybrid silica nanowires were fabricated in a specially designed platform that incorporates both the fiber tapering process and the controlled deposition of sol-gel thin layers [4]. The results and methodology presented in this work demonstrate the benchtop manufacturing and processing of this type of hybrid waveguides, even at room temperature.

References

[1] Mark A. Foster, Amy C. Turner, Michal Lipson, and Alexander L. Gaeta, "Nonlinear optics in photonic nanowires," *Optics Express*, vol. 16, no. 2, p. 1300, 2008.

[2] T. A. Birks, W. J. Wadsworth, and P. St. J. Russell, "Supercontinuum generation in tapered fibers," *Optics Letters*, vol. 25, no. 19, pp. 1415-1417, 2000.

[3] Pantelis Velanas, George Kakarantzas, and Christos Riziotis, "Flat mid-infrared supercontinuum generation in tapered fiber with thin coating of highly nonlinear glass," in *SPIE LASE* , San Francisco, CA, 2015.

[4] G. Kakarantzas, Leon-Saval S.G., T.A. Birks, and P.St.J. Russell, "Low-loss deposition of solgel-derived silica films on tapered fibers," *Optics letters*, vol. 29, no. 7, pp. 694-696, 2004.