Silica holey fibres: fabrication and nonlinear effects

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Holey fibres (HFs) [1] have emerged as a novel class of optical fibres which can provide completely new optical properties, such as endlessly single mode operation and novel dispersion properties as anomalous dispersion below 1.3μm, broadband flat dispersion and highly normal dispersion at 1.55 μm. Moreover by changing the HF parameters (i.e. hole and core size), it is possible to fabricate HFs with an effective area so high as 800μm^2 or so low as approximately 1μm^2 [2].
A holey fibre perform is fabricated by stacking silica rod and capillaries inside a silica tube. This perform is then drawn to a fibre using a conventional fibre drawing equipment.
In particular we will discuss the basic fabrication procedure for the production of HFs with a very high nonlinearity, and describe recent progress in nonlinear applications of HFs.
For example we have demonstrated for the first time a HF-based Brillouin laser. This experiment used a robust silica jacketed HF with a 1.5 μm core, a 100μm outer diameter (see figure 1) and an effective area of 2.85μm^2. The laser threshold was found to be 125mW, and the slope efficiency ~70% [3].

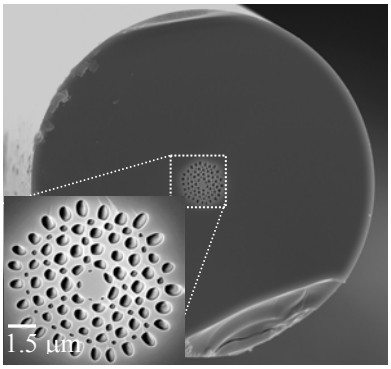

Fig 1. SEM of a HF with a 1.5μm core

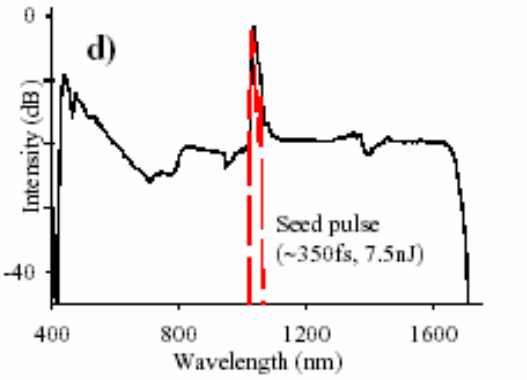

Fig 2. Broadband continuum spectra

By using the same fibre perform and modifying the drawing parameters during the fabrication process, we obtained a different HF with a standard outer dimension of 125μm and a 2μm core. Using this fibre we achieved ultra-broad supercontinuum generation, as shown in figure 2, by launching 20KW peak power pulses at 1.06μm into 7 meter fibre length[4].

References
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