Nonlinear optics in silicon fibre micro structures

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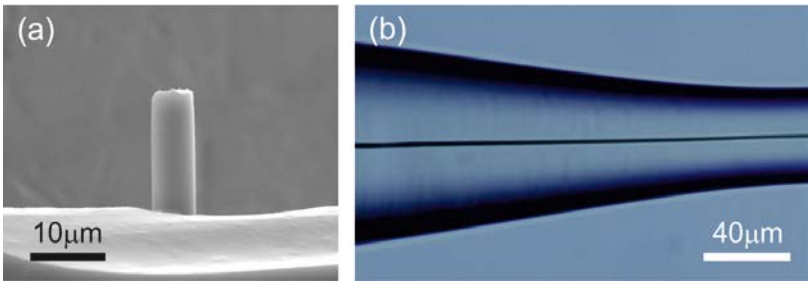
Silicon photonic devices are becoming an increasingly popular platform for nonlinear optical applications owing to the high Kerr nonlinearity and tight optical confinement. Although typically these devices are fabricated from silicon planar wafers using standard photolithographic and etching techniques, more recently alternative fiber-based platforms have emerged [1]. In this paper we will review methods to fabricate novel micro-scale devices from our silicon fiber platform using standard fiber post-processing techniques. Fig. 1 shows two geometries that are unique to the fiber platform; microcylindrical silicon resonators [2] and tapered silicon core waveguides [3]. The ability to arbitrarily tailor the dimensions in these devices to manipulate the light confinement is of particular interest for low power, high speed nonlinear optical processing. For example, we will show that the ultra-small mode volume of the resonators can be exploited for ultrafast Kerr optical switching and modulation, whilst the longitudinally varying waveguide parameters of the tapers can be used for nonlinear pulse shaping at modest power levels.



Silicon fiber micro structures: (a) microcylindrical resonator and (b) tapered silicon core fiber.

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