Magnesium fluoride microresonators are a well-established platform for the generation of optical frequency combs[1]. The ultra-high finesse achievable in this material enables the large intracavity intensities required for cascaded four-wave mixing and the comb formation process. Here, we consider photonic belt resonators [2]: consisting of a thin belt (∼ 5 × 5 µm) machined into a MgF₂ cylinder. The resonators were fabricated using diamond turning techniques, achieving a finesse of 2 × 10⁵. Owing to the restricted mode confinement provided by the belt, these devices support only a few whispering-gallery modes. This is crucial for the generation of frequency combs free from defects arising from linear mode interactions. By coupling 100 mW of power (λ = 1550 nm) into the resonator through a tapered fiber (waist ∼ 1 µm) and tuning into resonance, the generation of a frequency comb is observed (shown in Fig. 1). The resonator dimensions were engineered such that the resonator exhibited a small anomalous second-order dispersion (β₂) and a large third-order dispersion (β₃) [3]. This additionally permits the spectral extension of the frequency comb via a strong dispersive wave, and results in broadband frequency combs.

Figure 1: (Left) A photonic belt resonator, inset shows the surface as imaged by an optical profiler. (Right) Soliton spectrum excited around 1550 nm, stabilized by a laser at 1580 nm.