Title: Ultra-broadband three-octave supercontinuum generation in a dispersion-engineered chalcogenide inverse rib waveguide

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Abastact: This paper presents a novel dispersion-engineered inverse rib waveguide design for ultra-broadband supercontinuum generation (SCG), utilizing an As2×Se3 chalcogenide glass core with GeAsS/MgF2 cladding layers. The proposed structure achieves dispersion flattening over a wide range, enhancing nonlinear interactions for efficient spectral broadening under a 3.6 μm pump laser. Optimized waveguide geometry and material composition yield an output spectrum spanning 1.99–16.58 μm (3.06 octaves) at 4 kW peak pump power. Even at a reduced pump power of 2 kW, the supercontinuum extends from 4 μm to 16 μm, covering nearly two octaves, showcasing superior spectral broadening at lower power compared to other designs. The design maintains power stability and near-zero dispersion, which are essential for coherent SCG. The broad spectral range and low-power efficiency make the waveguide suitable for environmental monitoring, gas sensing, chemical analysis, biomedical imaging, and thermal imaging. Integration of MgF2 cladding enhances mechanical durability and stability.

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