

Femtosecond Pulse Generation by the Use of Mechanically Exfoliated ReS₂

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Abstract

Since the emergence of graphene, layered semiconducting transition metal dichalcogenides (TMDs) has attracted much attention in the mode-locked fiber lasers field as saturable absorbers (SA) due to its broadband (near infrared to visible) energy gap tuning from indirect (bulk) to direct (monolayer) optical transitions and ultrafast nonlinear optical responses for photonics and optical communications applications. Among the TMDs, rhenium disulfide (ReS₂) has shown remarkable optical properties as strong anisotropic and bulk-monolayer direct energy gap transitions (1.35-1.43 eV). In the SA field, mode-locked Erbium doped fiber lasers (EDFL) have been reported using chemical deposition vapor (CVD) [1, 2], liquid phase exfoliation [3] ReS₂ as SA at 1550 nm. For the first time, we report a femtosecond pulse generation using mechanically exfoliated ReS₂ deposited onto the polished surface of D-shaped optical fiber (Figure 1) in an EDFL. The sample exhibited 21 dB (99%) relative polarization extinction ratio [4, 5], resulting in mode-locking performance of 22 nm bandwidth and 220 fs pulse duration (Figure 2 – inset). This is the best mode-locking performance ever reported in the literature for all-fiber ReS₂ SA in EDFL.

References

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- [2] F. Lu, *Modern Physics Letters B.* 31, (2017), 1750206.
- [3] D. Mao *et al.*, *IEEE Journal of Selected Topics in Quantum Elect.* 24, (2017), 1100406.
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Figures

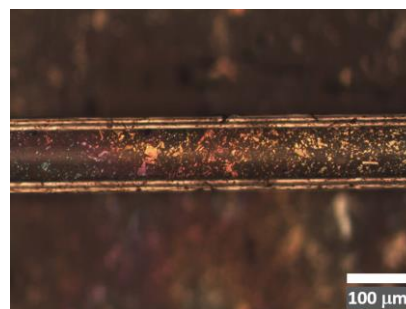


Figure 1: Optical image (10X) of mechanically exfoliated ReS₂ deposited onto the D-shaped optical fiber polished surface.

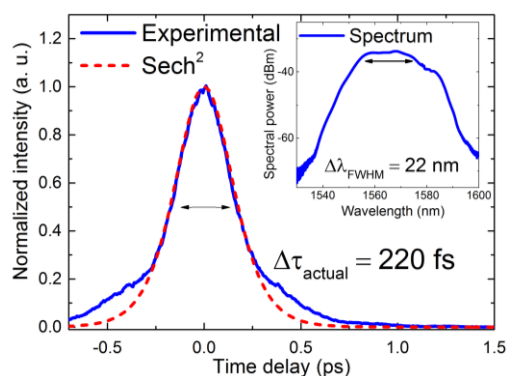


Figure 2: Spectrum (inset – log scale spectrum) and pulse duration.

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