

Ultrashort Pulse Generation Using Mechanically Exfoliated MoS₂ in Erbium Doped Fiber Laser

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Abstract

This is the first demonstration of a mode-locked Erbium Doped Fiber Laser (EDFL) using mechanically exfoliated MoS₂ onto D-shaped optical fiber and the shortest pulse duration ever reported in literature by using MoS₂ saturable absorber (SA) in EDFL. Since the graphene was isolated, other two-dimensional (2D) nanomaterials have been attractive in many possible applications [1]. The transition metal dichalcogenides such as MoS₂ have exhibited remarkable nonlinear optical properties [2], being used to generate ultrashort pulses in fiber lasers as SA in EDFL, but most of them fabricated by liquid phase exfoliation or chemical vapor deposition growth [3, 4]. In this work, we prepared a mechanically exfoliated MoS₂ sample and transferred onto 10 mm length of D-shaped optical fiber side-polished surface. For its transference, we used the Rosa *et al.* [5] method, consisting of PVA/PMMA polymeric substrate preparation over SiO₂ substrate. The characterization of the MoS₂ sample was performed by using optical microscope and Raman spectroscopy, shown in Figure 1. Its polarization performance was measured to be 16.06 dB (97.5%) of polarization relative extinction rate. When incorporated the SA in the laser cavity, it can be generated a spectral bandwidth of 20.5 nm, corresponding to 200 fs pulse duration (Figure 2) at cavity fundamental repetition rate of 14.53 MHz.

References

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- [5] H. G. Rosa *et al.*, *2D Materials* 2 (2015), 031001.

Figures

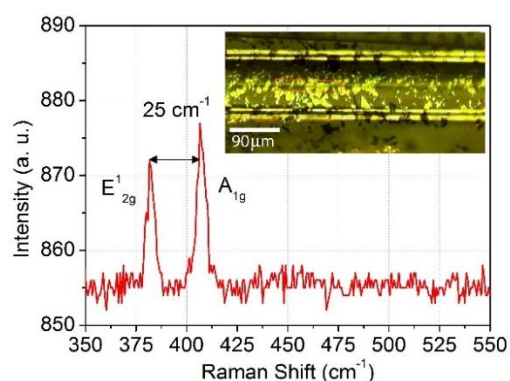


Figure 1: Raman spectroscopy of MoS₂ showing the $E'_{2g} = 382 \text{ cm}^{-1}$ and $A_{1g} = 407 \text{ cm}^{-1}$ modes (inset – optical image of bulk MoS₂ flakes onto polished surface of D-shaped optical fiber).

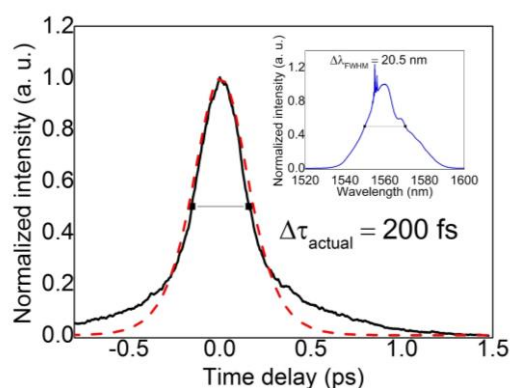


Figure 2: Autocorrelation trace (inset – output linear spectrum) obtained with MoS₂ sample onto D-shaped optical fiber in an EDFL.

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