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Nonlinear optical modulation and ultrafast dynamics of Fe-BTC in a 2 μm thulium-holmium fiber laser

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Abstract

While Fe-BTC, a semiamorphous metal–organic framework (MOF), has been established for gas storage and catalysis, its application as a saturable absorber (SA) remains unexplored. In this work, Fe-BTC was successfully implemented as an optical modulator to generate ultrafast pulses in a thulium-holmium-doped fiber laser (THDFL). Fe-BTC was drop-casted on an arc-shaped fiber to form the optical modulator, yielding a modulation depth of 2.1%. With a 3-dB spectral bandwidth of 2.7 nm, the output wavelength was centered at 1896.7 nm. The repetition rate was 14.7 MHz, and the pulse width was 1.5 ps, corresponding to an optical peak power of 91 W and a pulse energy of 136 pJ. The system operated steadily, as evidenced by its signal-to-noise ratio (SNR) of around 55 dB. This study reveals the capabilities of Fe-BTC as a low-cost saturable absorber for ultrafast fiber lasers. © 2026 The Author(s). Published by IOP Publishing Ltd.

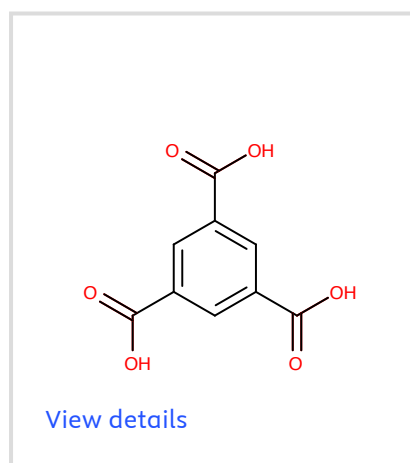
Author keywords

Fe-BTC; fiber laser; metal-organic framework; mode-locking; saturable absorber

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