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Cu-MOF as a saturable absorber for mode-locking at 2 μm and beyond

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Abstract

In this study, a copper-based metal–organic framework (Cu-MOF) was synthesized using terephthalic acid (TPA, H_2L), 1,2-bis(4-pyridyl)ethene (bpe) as organic binders, and Cu^{2+} ions, to act as a saturable absorber (SA) material. The SA was fabricated by depositing Cu-MOF on an arc-shaped fiber, and was then incorporated into a thulium-doped fiber laser (TDFL) and a holmium-doped fiber laser (HDFL), with both achieving stable mode-locking operation. The SA exhibited a modulation depth of 5.7% and a saturation intensity of 13.8 MW/cm^2 , respectively. The maximum average output power of the TDFL was 6.82 mW, while that of the HDFL was 2.64 mW. Pulse widths were measured at 1.08 ps for the TDFL and 1.75 ps for the HDFL respectively. The TDFL achieved a pulse energy of 464 pJ and a peak power of 430 W. The output of the HDFL had a pulse energy of 180 pJ and a peak power of 94.9 W, respectively. Both lasers were monitored for 4 h to ensure their stability. © The Author(s) 2025.

Author keywords

Holmium-doped fiber laser; Metal–organic frameworks; Mode-locking; Saturable absorber; Thulium-doped fiber laser

Indexed keywords

EMTREE drug terms

copper; cupric ion; ethylene; holmium; metal organic framework; terephthalic acid; thulium

EMTREE medical terms

article; controlled study; human; laser

Chemicals and CAS Registry Numbers

Unique identifiers assigned by the Chemical Abstracts Service (CAS) to ensure accurate identification and tracking of chemicals across scientific literature.

copper	15158-11-9, 7440-50-8
ethylene	74-85-1
holmium	7440-60-0
terephthalic acid	100-21-0
thulium	7440-30-4

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Universiti Malaya See opportunities by UM ↗	RU001-2025A	UM

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