Studying the influence of deposition methods on ultrashort pulse generation

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Abstract

This study investigates the influence of deposition methods on the laser performance of Erbium-doped fiber lasers (EDFL). Two deposition methods, namely the drop-casting and airbrush-sprayed techniques, were employed. The reduced graphene oxide/magnesium oxide (rGO/MgO) composite applied using drop-casting on arc-shaped fiber shows a higher modulation depth of 3.27 %, surpassing the 2.12 % achieved by the airbrush-sprayed version. Both composites' structures ensure high thermal stability, allowing for continuous operation for 5 hours without performance degradation. The generation of mode-locking in the EDFL occurred when the incident light interacted with the rGO/MgO composite through the evanescent wave, reaching the threshold pump power of 389.69 mW. Integrating the saturable absorber (SA) in the cavity and adjusting the polarization controller (PC) enables stable pulse generation with a pulse duration of 0.91 ps for drop-casted arc-shape fiber and 1.32 ps for sprayed arc-shape fiber with a fundamental frequency of 18.10 MHz. The difference in modulation depth and laser performance is due to the condensed deposition

achieved using drop-casting, resulting in improved interaction between light and matter and better saturable absorption properties. The results of this research provide a compelling alternative for ultrafast fiber lasers that are both compact and efficient, and they have the potential to be utilized in high-speed optical communication as well as medicinal imaging technologies. © 2025 Elsevier B.V.

Author keywords

Drop-casting technique; Mode-locking; Reduced graphene oxide/Magnesium oxide; Saturable absorber; Spraying technique

Indexed keywords

Engineering controlled terms

Incident light; Mode-locked fiber lasers; Optical pumping; Saturable absorbers

Engineering uncontrolled terms

Casting techniques; Deposition methods; Drop casting; Drop-casting technique; Erbium-doped fiber lasers; Laser performance; Modelocking; Reduced graphene oxide/magnesium oxide; Reduced graphene oxides; Spraying techniques

Engineering main heading

Ultrashort pulses

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Abstract

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