

Site-Specific Optical Encryption Via Nano Scale Integration of Carbon on Monolayer WS2

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ABSTRACT

A method (100) for electron beam induced deposition (102) of nano-structured Carbon on atomically thin 2D materials may be provided. The method (100) may include site specific integration of carbon nanostructures (104) on WS2 (106) monolayer to obtain a nanostructure pattern. Further, the method may include optical encryption (108) by the integration of carbon nanostructures in 2D material. The site-specific integration of carbon nanostructures (104) may facilitate strong interaction, charge transfer between the carbon nanostructures and WS2 monolayer which may modify the optical emission, thereby possibly used for the secure transmission of sensitive information.

KEY APPLICATION AREAS

1. Optical Data Encryption & Information Security.
2. Nanophotonics & Optoelectronics.
3. 2D Materials & Nanotechnology.
4. Secure Data Storage & Anti-Counterfeiting.
5. Nanoscale Patterning & Nanofabrication.
6. Photonics Research & Optical Devices.

POTENTIAL USE

1. Optical encryption for secure transmission and storage of sensitive information using nanoscale carbon patterns on WS₂.
2. Invisible security markings and anti-counterfeiting labels detectable only through photoluminescence (PL) imaging.
3. Nanoscale optical data writing, reading, and erasing for confidential information storage.
4. High-resolution, chemical-free nanopatterning of WS₂/MoS₂ for photonic and optoelectronic devices.
5. Photoluminescence engineering through site-specific carbon integration to tune optical emission properties.
6. Fabrication of nanoscale photonic structures using electron beam-induced deposition (EBID) without resist processing.
7. Research platform for 2D material-based optical and quantum devices with controlled nanoscale patterning.