Technology Offer

All-in-one nanoprinting approach for the synthesis of unclonable anti-counterfeiting nanofilms

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In addition to causing trillion-dollar economic losses every year, counterfeiting threatens human health, social equity and national security. Current materials for anti-counterfeiting labelling typically contain toxic inorganic quantum dots and the techniques to produce unclonable patterns require tedious fabrication or complex readout methods. Carbon dots (CDs) stand out because of their stability, low toxicity, widely available precursors and bio-/ecofriendly preparation. However, most reported CDs only fluoresce in solution and suffer from quenching in the solid state. Doping CDs into matrices is the state-of-the-art to achieve solid-state fluorescence (SSF), but requires additional post-treatment and results in a substantial spectral shift with competitive non-radiative decay or obvious concentration-dependent luminescence characteristics, which limits their compatibility with printing technologies.

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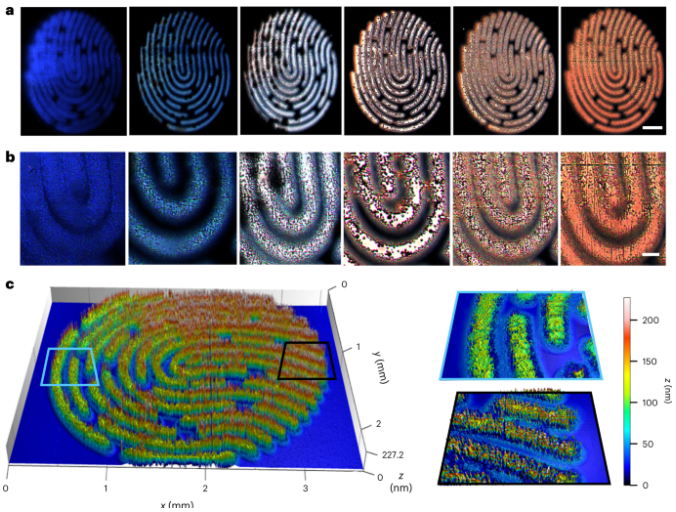
Scientists from the Max-Planck-Institute of Colloids and Interfaces have developed a nanoprinting-assisted flash synthesis approach that generates fluorescent nanofilms with physical unclonable function micropatterns in milliseconds. This all-in-one approach yields quenching-resistant carbon dots in solid films, directly from simple monosaccharides. Moreover, they established a nanofilm library comprising 1,920 experiments, offering conditions for various optical properties and microstructures. They produced 100 individual physical unclonable function patterns exhibiting near-ideal bit uniformity (0.492 ± 0.018), high uniqueness (0.498 ± 0.021) and excellent reliability (>93%). These unclonable patterns can be quickly and independently read out by fluorescence and topography scanning, greatly improving their security. An open-source deep-learning model guarantees precise authentication, even if patterns are challenged with different resolutions or devices.



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Patent Information

A priority application was filed in 2023.

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