New type of barcode could make counterfeiters' lives more difficult

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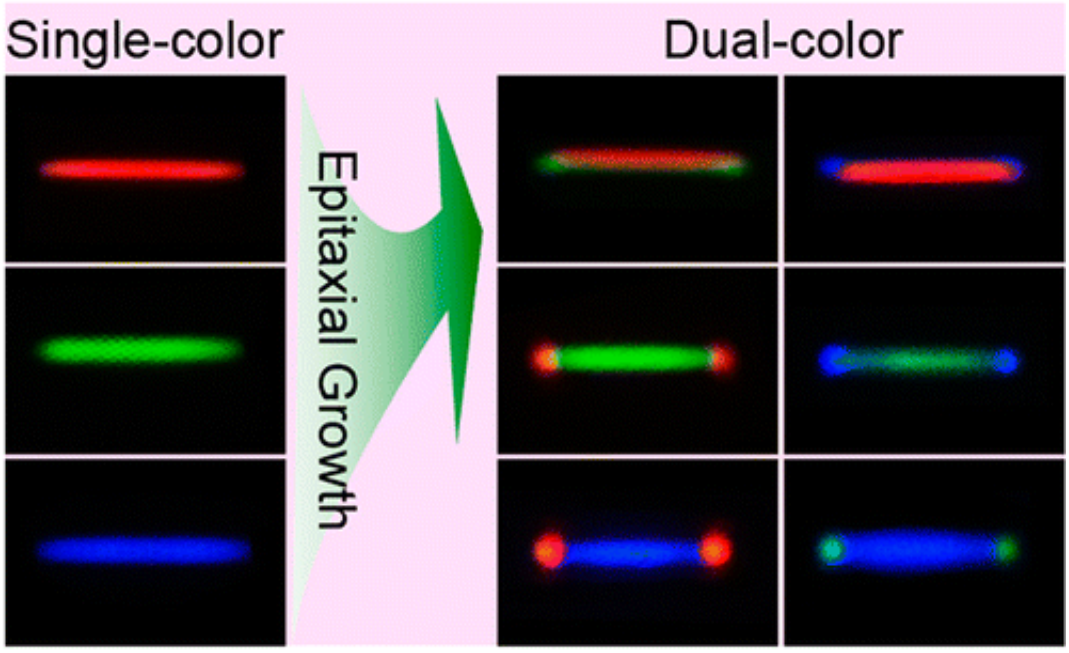

Counterfeiters, beware! Scientists are reporting the development of a new type of inexpensive barcode that, when added to documents or currency, could foil attempts at making forgeries. Although the tags are easy for researchers to make, they still require ingredients you can't exactly find at the local hardware store. Their report appears in the *Journal of the American Chemical Society*.

Xiaogang Liu and colleagues explain that scientists have used fluorescent and DNA-based barcodes, or tags of known composition and sequence, in attempts to develop tests for cancer and other diseases. But their high cost and faint signal have hampered their application in security inks. One estimate states that about $220 million in counterfeit bills are currently in circulation just in the U.S., and there's no way to tell how many other "official" documents are fake. Liu's team set out to thwart counterfeiters and overcome these obstacles by using microscopic "lanthanide-doped upconversion materials." Lanthanides are a set of elements that are in a wide variety of products, including ceramics, glass and portable x-ray devices.

The team made a set of multicolor barcodes with different combinations of red, green or blue fluorescent dots on either end of a tiny lanthanide-containing microrod using an inexpensive process. They then used these microrods to produce a transparent security ink. In this format, the barcodes are easily readable with a conventional microscope fitted with a near-infrared laser, but are invisible to the naked eye. They say the materials also could find application in imaging cells from the body.

More information: "Multicolor Barcoding in a Single Upconversion Crystal" J. Am. Chem. Soc., 2014, 136 (13), pp 4893–4896. DOI: 10.1021/ja5013646

Abstract
We report the synthesis of luminescent crystals based on hexagonal-phase NaYF4 upconversion microrods. The synthetic procedure involves an epitaxial end-on growth of upconversion nanocrystals comprising different lanthanide activators onto the NaYF4 microrods. This bottom-up method readily affords multicolor-banded crystals in gram quantity by varying the composition of the activators. Importantly, the end-on growth method using one-dimensional microrods as the template enables facile multicolor tuning in a single crystal, which is inaccessible in

conventional upconversion nanoparticles. We demonstrate that these novel materials offer opportunities as optical barcodes for anticounterfeiting and multiplexed labeling applications.

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