

# Printable Down-/Up-Conversion Fluorescence Inks for Anti-Counterfeiting Applications

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## Abstract

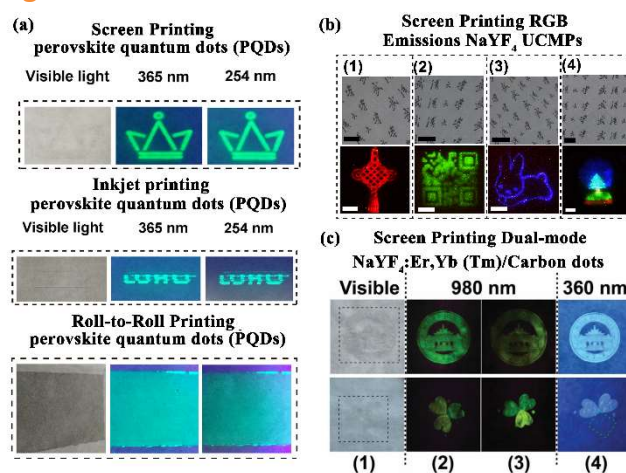
Fluorescence materials including up-conversion and down-conversion fluorescence materials play a crucial role in encoding information for anti-counterfeiting because of their inherent optical properties and stability against degradation. However, the current optical anti-counterfeiting labels have a limited capacity for information storage or complexity to prevent counterfeiting. Here in, we developed a series of anti-counterfeiting labels based on various fluorescence inks of CsPbX<sub>3</sub> (X=Cl, Br, I) perovskite quantum dots (PQDs), red-green-and blue (RGB) emissions NaYF<sub>4</sub> up-conversion micro-particles (UCMPs) [1-2] and dual-mode luminescent NaYF<sub>4</sub>:Er,Yb (Tm)/carbon dots [3] via straightforward and low-cost strategies, including spin-coating, stamping, screen printing, inkjet printing and roll-to-roll printing. Under ambient conditions, the printed patterns are invisible, while, all the patterns could display colorful, designable and high-resolution patterns under near-infrared (NIR) or ultraviolet (UV) light excitation. All tunable and versatile transparent anti-counterfeiting labels based on as-prepared fluorescence inks possess the merits of easy-manufacture and high concealing, underlying the practical application for high-capacity information encoding and protecting the switch of authentic goods.

## References

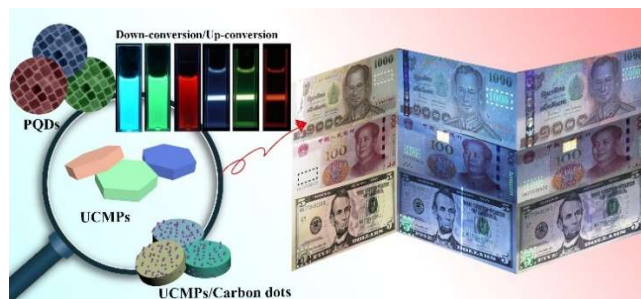
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screen printing of dual-mode luminescent NaYF<sub>4</sub>:Er,Yb (Tm)/carbon dots for anti-counterfeiting applications. *Journal of Materials Chemistry C* 2017, 5 (26), 6512-6520.

## Figures



**Figure 1.** Versatile optical micrographs of the printed patterns based on different fluorescence inks through various printing strategies. (a) Screen printing, inkjet printing and roll-to-roll printing perovskite quantum dots (PQDs) inks. (b) Screen printing RGB emissions NaYF<sub>4</sub> UCMPs inks. (c) Screen printing dual-mode luminescent NaYF<sub>4</sub>:Er,Yb (Tm)/carbon dots inks.



**Figure 2.** Printable up-/down-conversion fluorescence inks including PQDs, UCMPs and dual-mode luminescent UCMPs/carbon dots inks for banknotes protection applications.