

NAMI Smart Reactive Color Changing Materials

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20230113*



NAMI Smart Reactive Color Changing Materials

Chromic materials
Color changing materials

Photochromism

Mobile flashlight
Or
UV

Artwork/paint Security printing

Thermochromism

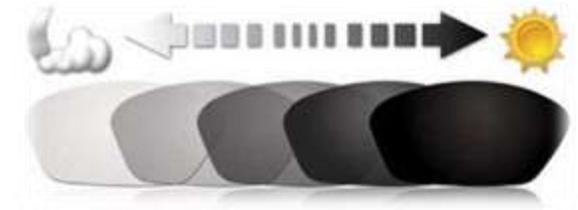
30 to 50 °C

Thermochromic temperature sensor

Fluorescent

Luminescence

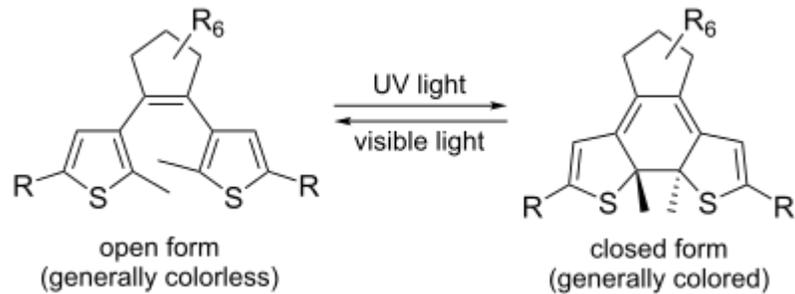
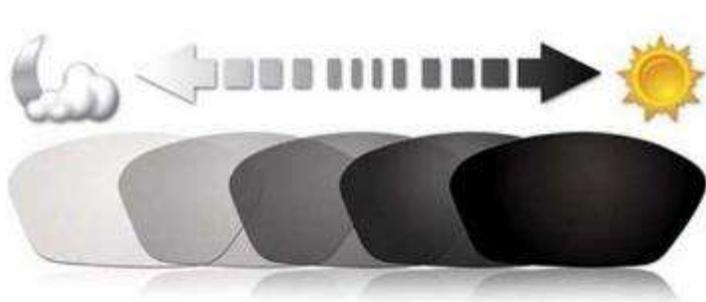
Secret printing/
security printing



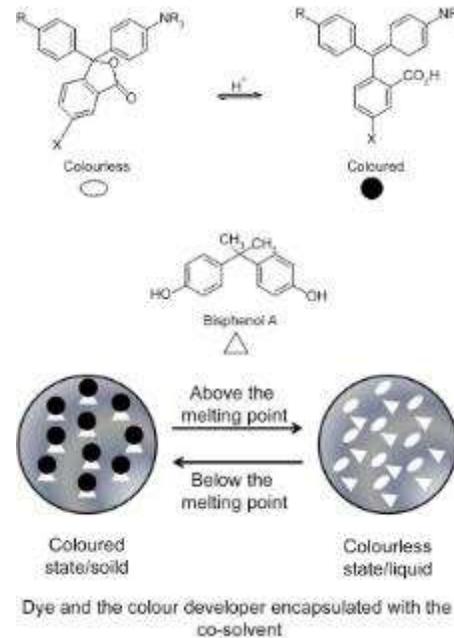


Theory of color changing effect

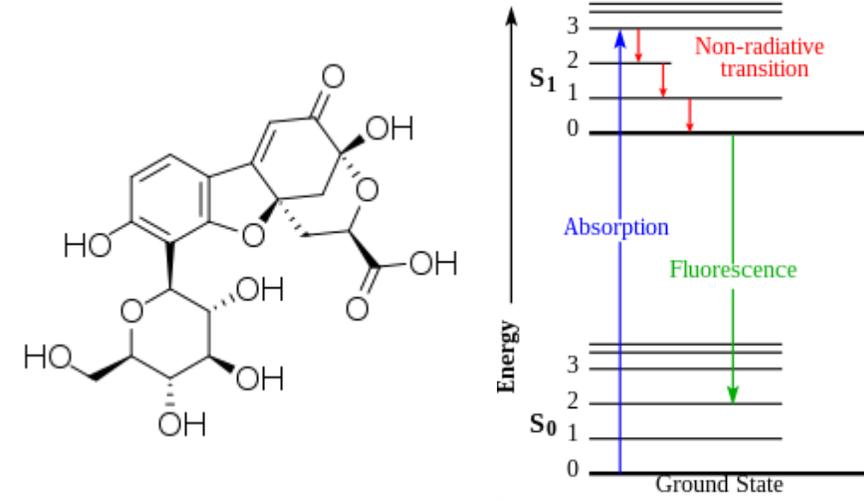
Photochromic



Thermochromic

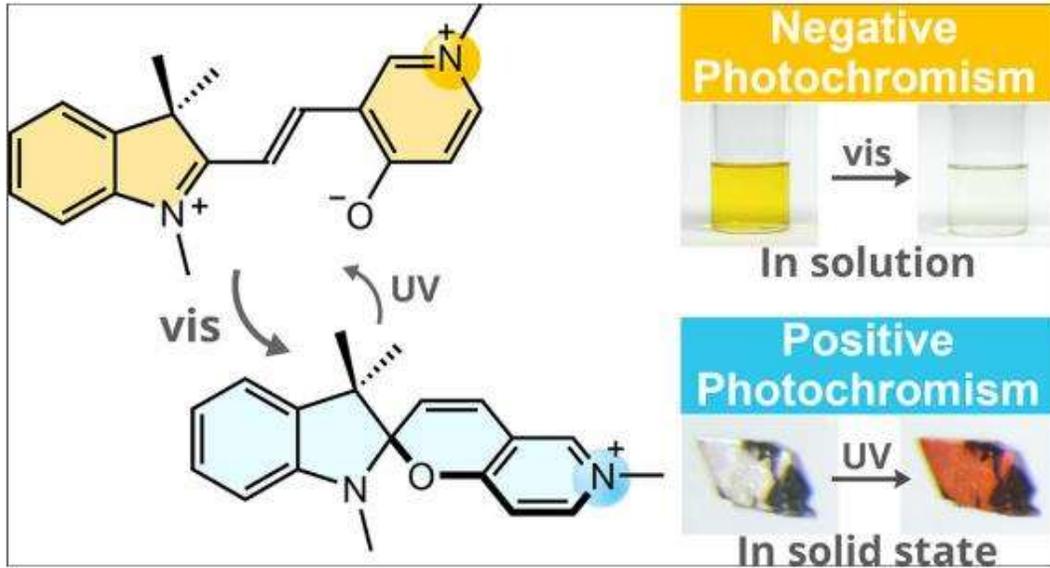


Fluorescence

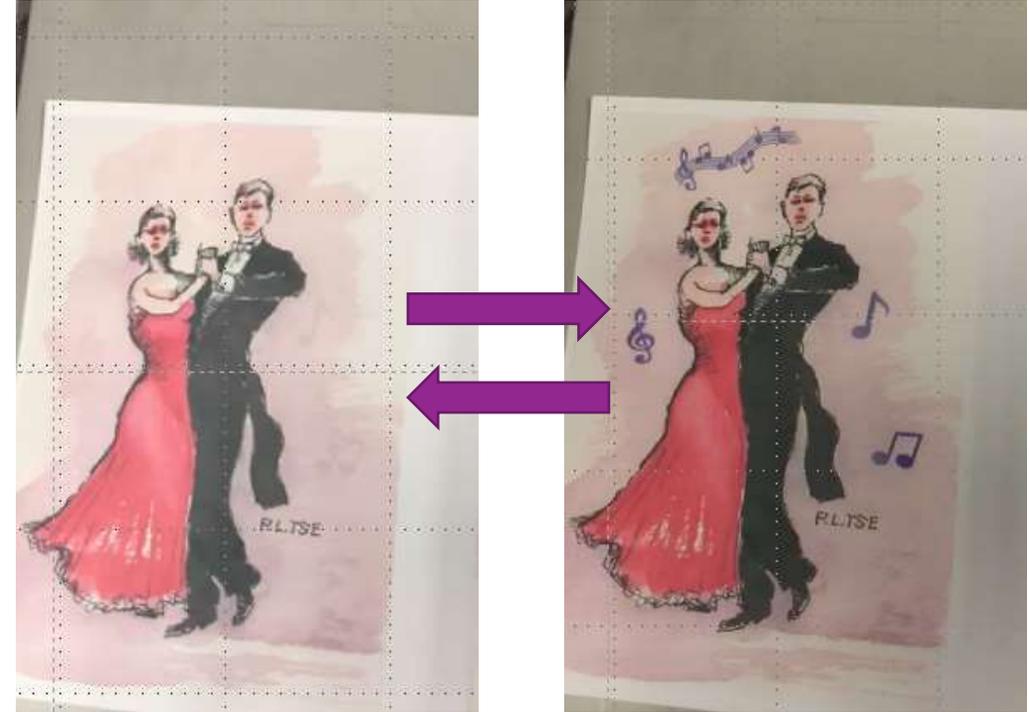




Conventional-UV trigger photochromic materials



- Triggered by UV light
- Perform stable and robust color changing effect
- Color: Orange, Red, Purple
- Organic based

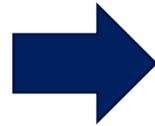
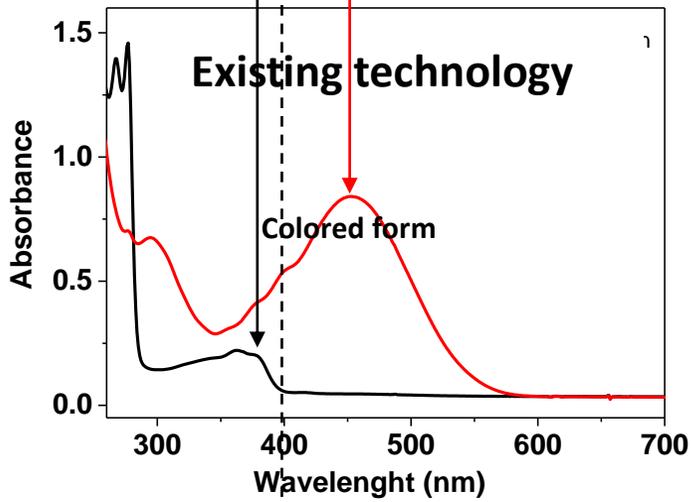
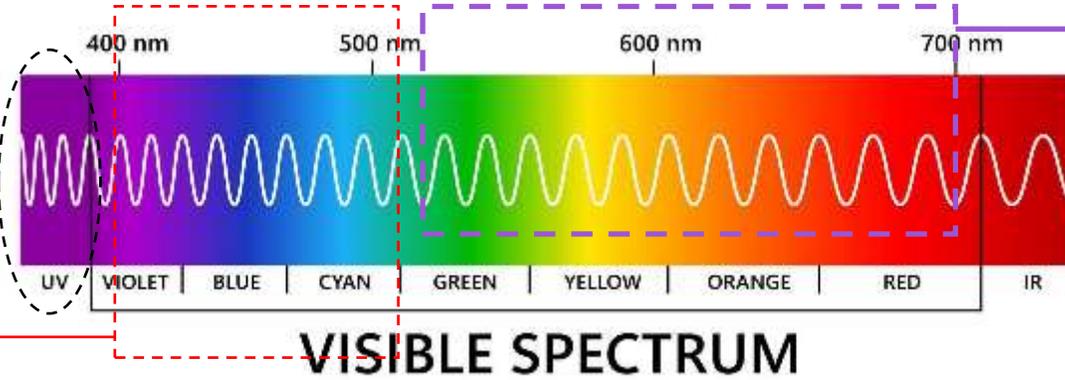


Features:

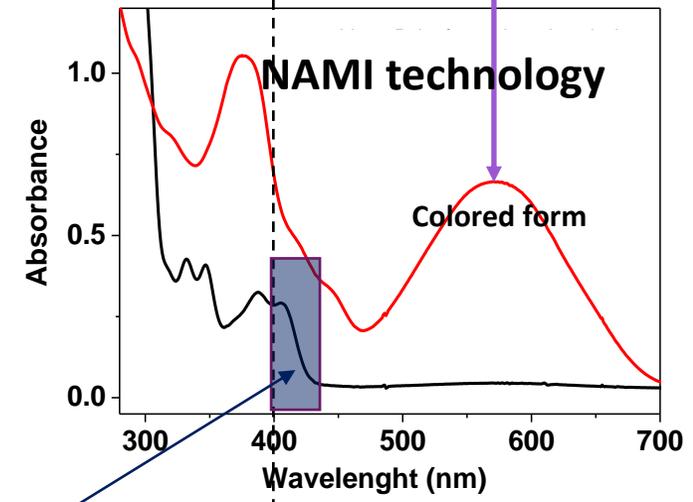
- Home-made structure
- Stable and reversible



New-Visible light trigger photochromic materials



Chemical structure modification

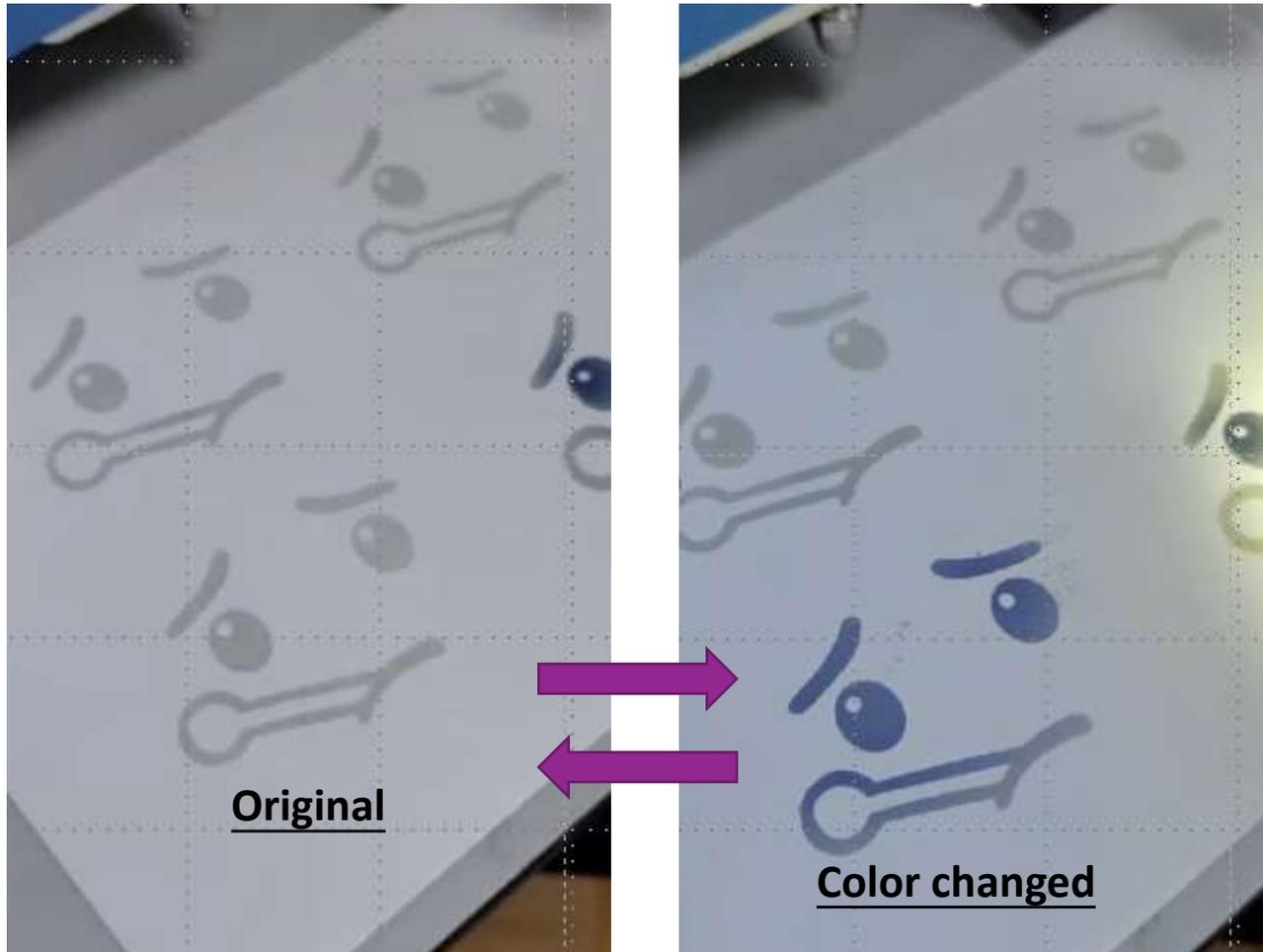


***New spectral area obtained!**

➤ **Visible light region (violet and blue region)**



Demonstration-visible light color changing effect



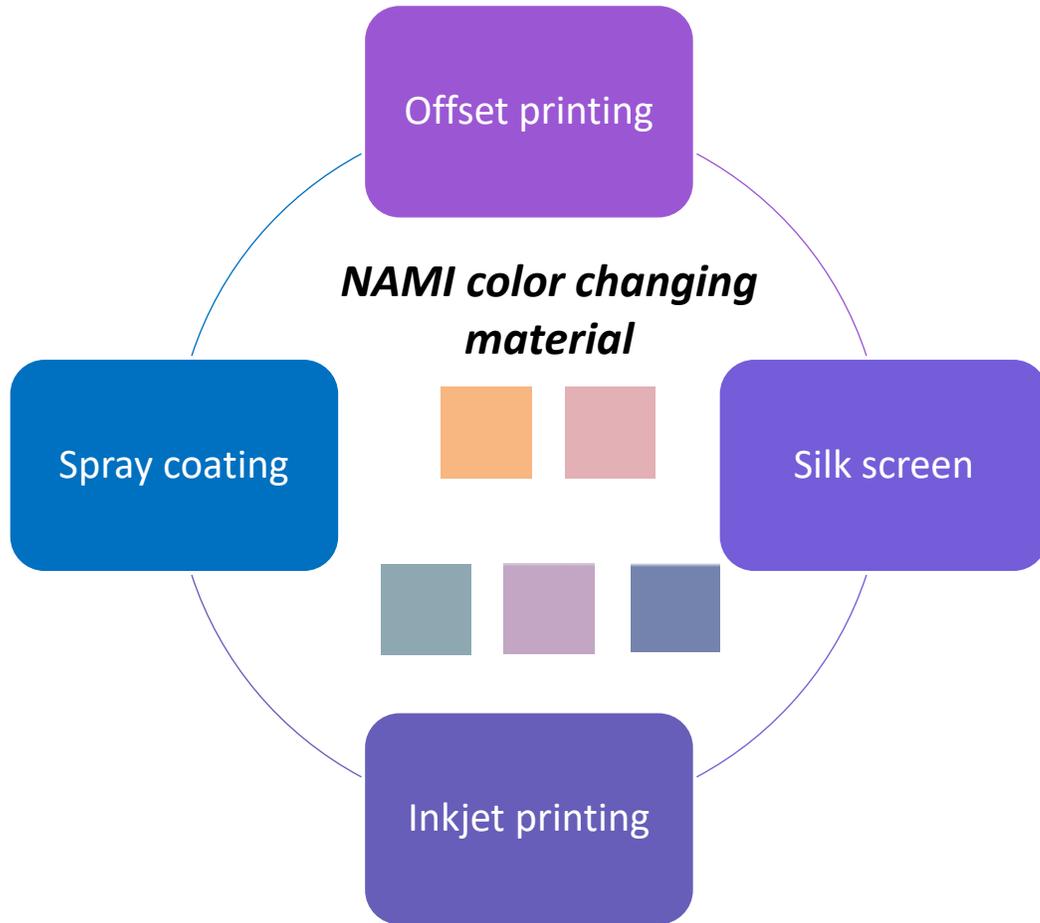
Features:

- Triggered by visible light
- Perform stable and robust color changing effect
- Color: Blue and Purple
- Organic based
- Home-made structure

US Patent Granted



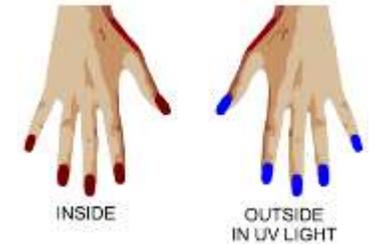
Methods and applications



Printing



Cosmetic



Packaging



Anticounterfeiting

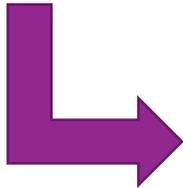




Toxicity and safety tests

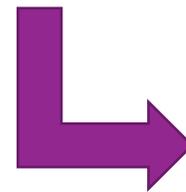
Toxicity test:

- Acute toxicity (oral)
- Acute toxicity (dermal)
- Skin corrosive /irritation
- Serious eye damage/ irritation



Safety test:

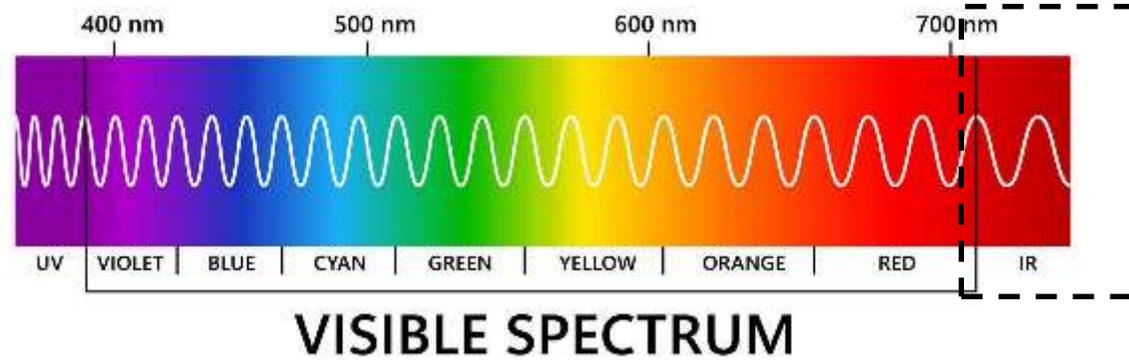
- EN71-3
- Cadmium (REACH)
- AZO Colorants
- Formaldehyde content
- Vinyl Chloride Monomer Content



- ***Other toxicity tests (can be included in projects)***
- ***New chemicals registration (CAS code, MSDS...)***



New opportunity (Anticounterfeiting) IR absorbing+ emitting code



Invisible region

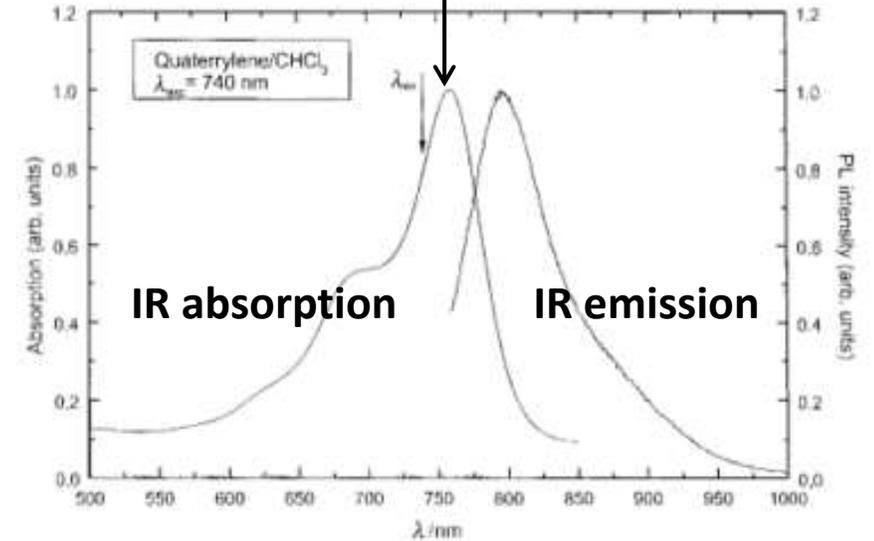
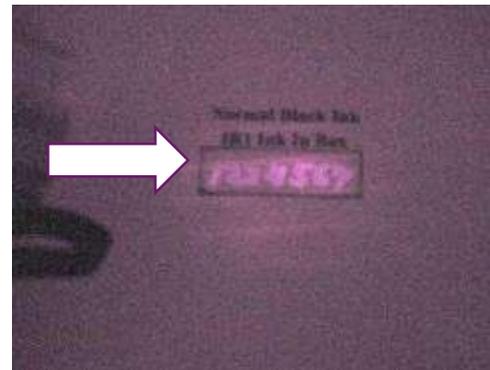
Invisible in visible light



IR absorption



IR emission



- Need special light source/ detectors to read the images



New opportunity (Anticounterfeiting) Dual color emission code



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Potential End-Use of a Europium Binary Photoluminescent Ink for Anti-Counterfeiting Security Documents

Omar Woudam* and Omar Lakbita

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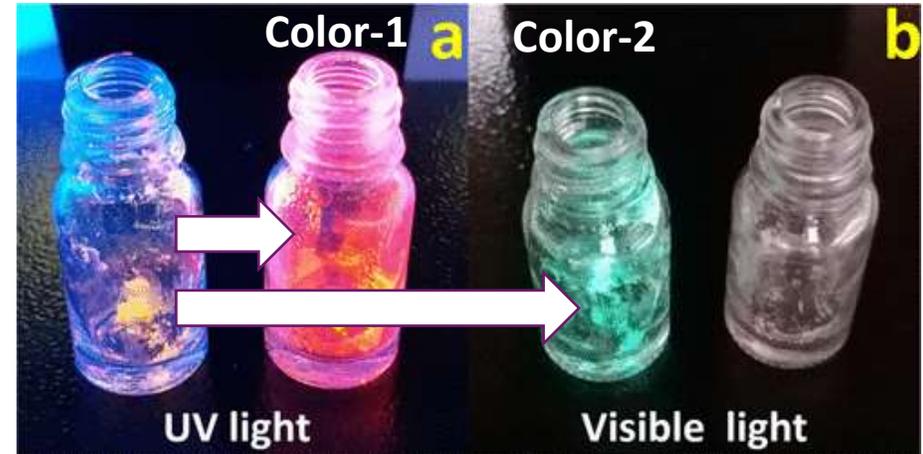
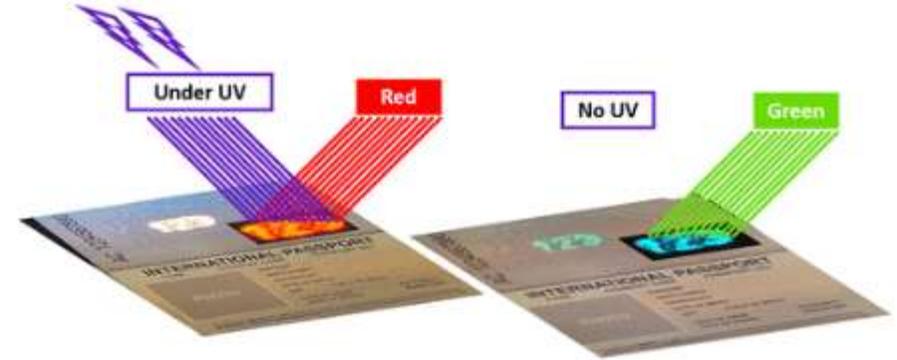
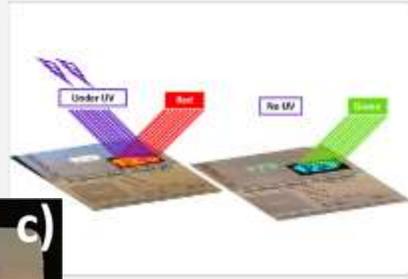
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Abstract

Composed of two europium complexes doped in polyvinyl butyral as the host material, a novel photoluminescent ink has been formulated by synthesizing $\text{Eu}(\text{FAC})_3\text{phen}$ as a red luminescent down-shifting emitter and employing $\text{SrAl}_2\text{O}_7:\text{Eu}, \text{Dy}$ as a long persistent green phosphor. Both emitters are incorporated to design a photoluminescent ink with binary emission under a single UV excitation wavelength, where a red light is emitted when exposed under 325 nm, subsequently becoming green upon the UV light being switched off. The concept presented here is unequivocally distinct from the classical dual-mode emission, which requires a second extra near-infrared excitation around 980 nm to produce a binary luminescence. This work demonstrates the effortlessness of using one UV excitation for dual-mode visible emission while rendering the counterfeiting of confidential documents more onerous.



➤ Red emission

➤ Long lasting after growth green emission



Calling for platform project in IR materials

Item	Details
Proposal submission deadline 截止日期	Feb 2023
Project vetting date 項目審核日期	Mar 2023
Project type 項目類別	Platform (平台)
Project starting date 項目開始日期	1 st Jun 2023 (2 years project)
Total project cost 項目成本	HKD 5.0M
Sponsorship from industry 贊助費	HKD 1.5M
Net sponsorship after cash rebate 淨贊助費 (現金回扣後) if applicable	HKD 0.90M/company (for 1 sponsor) HKD 0.45M/company (for 2 sponsors)
IP ownership 知識產權擁有權	NAMI