
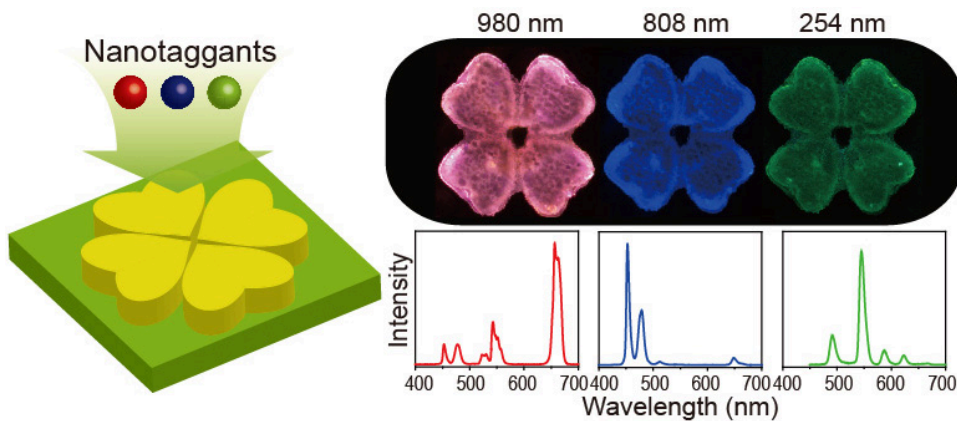





# Encrypting Anti-counterfeiting Patterns with Multi-Mode Luminescent Nanotagants

 **Communications & Information**  
 Nanotechnology and New Materials



**IP Status**  
 Patent granted



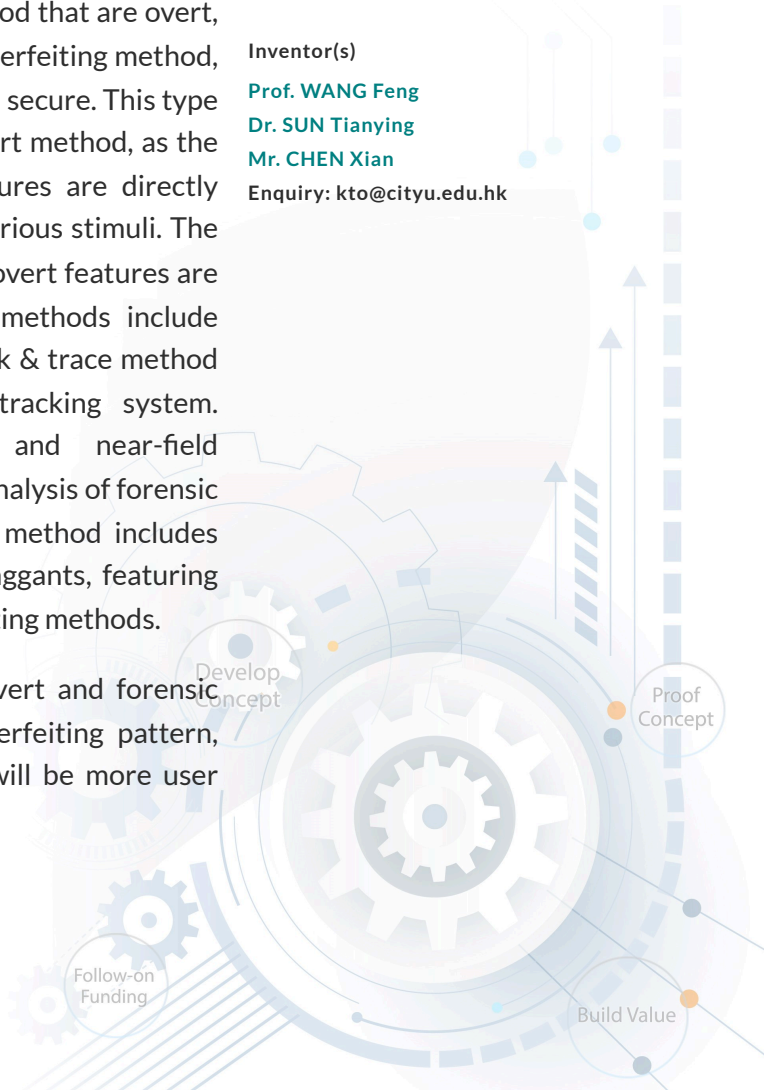
Technology Readiness Level (TRL)  

## Opportunity

In general, there are four types of anti-counterfeiting method that are overt, covert, trace & track and forensic. For the overt anti-counterfeiting method, the security features are obvious present therefore less secure. This type includes items such as holograms, color shifting, etc. Covert method, as the name implies, has hidden technology. The security features are directly unreadable by naked eyes but come into existence with various stimuli. The good thing is that, comparing to the overt method, these covert features are hard to copy, but it doesn't mean impossible. Covert methods include fluorescent inks, watermarks, polarized hidden image. Track & trace method is backed by an advanced database monitoring and tracking system. Representatives are radio-frequency identification and near-field communication. Forensic method requires a full scientific analysis of forensic features of a sample, probably in a laboratory. Forensic method includes items such as biological DNA taggants, micro- or nano-taggants, featuring the highest security level among those four anti-counterfeiting methods.

Our designed anti-counterfeiting pattern serves as a covert and forensic technique. Through the incorporation of this anti-counterfeiting pattern, suspicious packaging can receive laboratory analysis. It will be more user friendly, secure and not easy to duplicate.

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## Technology

This invention reports a strategy for the creation of anti-counterfeiting patterns that are encrypted with nanotaggants composed of lanthanide-doped nanoparticles. The feature of the invention is that color and graphic codes can be encrypted into anti-counterfeiting patterns. Decryption is achieved by examining the temporal color response of the pattern to different illuminations (i.e.; 980 nm, 808 nm, and 254 nm excitations). By changing the composition of nanotaggants, we can fabricate various anti-counterfeiting patterns with a large encoding capacity. The novelty of this invention is that our anti-counterfeiting pattern provides a color or graphic sequence for authentication purpose. The pattern can be proved genuine only if the desired color /graphic sequences are achieved, which make anti-counterfeiting patterns hard to duplicate. Furthermore, extra information can be extracted by a spectrometer as an ultimate forensic technique. Hence, our technique combines the covert and forensic anti-counterfeiting methods by providing encrypted information that can be read either by our eyes or with the assistance of professional equipment. The encryption technique described here is expected to increase the difficulty of duplication and thus to provide high-level securities.

## Advantages

- High Security level
- Hard to duplicate
- User Friendly

## Applications

- Food and beverages
- Pharmaceuticals and healthcare
- Industrial and automotive
- Clothing and accessories
- Electronic devices

