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Ph.D. thesis (2020-2023)
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Use of multispectral images in the analysis of printed microcodes to improve anti-counterfeiting strategies

Utilisation d'images multispectrales dans l'analyse de microcodes imprimés en couleur pour améliorer les stratégies d'anti-contrefaçon

Context

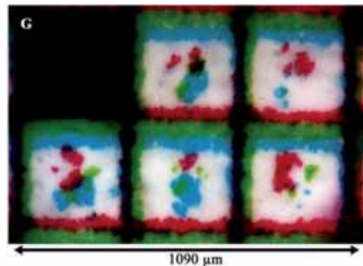
Anticounterfeiting: major challenge of this century

- **Economic issue:** counterfeited products represented 3,3% of the global trade in 2016 ¹
- **Security issue:** necessity to authenticate identity and fiduciary documents

Authentication strategies

- The LGP2 laboratory has developed an authentication strategy based on microcodes at the microscale:

Louis Vallat-Evrard.
(Communauté Université Grenoble Alpes, 2019) ²



- Optical phenomena within printed multilayer substrates are studied in the LaHC. These color effects could be used as security features.

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Objectives

Develop multiscale knowledge on halftones

- Study halftones at the microscopic and macroscopic scales.



Multispectral microscope ²

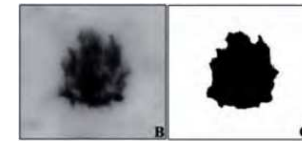
- Link microscopic halftone observation with the macroscale color rendering of this halftone.

Develop anticounterfeiting strategies

- Use the layered structure of the halftone material to produce hardly reproduceable color effects.
- Authenticate documents thanks to random artefacts occurring in printed microcodes at the microscale.

Methods

Microscopic multispectral study of microcodes



Ink-paper separation ²

Modelisation and experimental verification of optical phenomena

Specific focus on:

- Light diffusion inside the substrate (**spectral point spread function**)
- Effect of a coating layer (**halo effect**)
- Colored reflection of inks (**bronzing**)
- Colored primaries superimposing and juxtaposition

Creative watermarking of an image exploiting its material properties

Hide inside an image a feature which can be revealed only under specific circumstances thanks to optical phenomena.

¹ OECD/EUIPO, 'Trends in Trade in Counterfeit and Pirated Goods', Illicit Trade, OECD publishing, Paris/European Union Intellectual Property Office, 2019.

² Louis Vallat-Evrard, 'Mesure, analyse et modélisation à l'échelle microscopique de points imprimés pour améliorer les solutions de lutte anti-contrefaçon', Communauté Université Grenoble Alpes, LGP2, 2019.

