

PO1001

Optical Layer Systems for Product Authentication: Interference, Scattering, Light Diffusion and Ellipsometric Encoding as Public, Hidden and Forensic Security Features

Uwe Beck¹, Andreas Hertwig¹, Ralph Stephanowitz¹, Matthias Weise¹, Dirk Hönig², Stefan Schneider², Ralph Domnick³, Matthias Belzner³

¹BAM, Berlin, Germany ²Accurion GmbH, Göttingen, Germany ³Ara Coatings GmbH & Co. KG, Erlangen, Germany

uwe.beck@bam.de

Embedding of information on surfaces is state of the art for identification testing in which public, hidden and forensic features are used. In many instances, the legal authentication of a product, a material or a document is required. Among the surface-based encoded labels, bar codes are most frequently applied. They are public features, the material itself is irrelevant, only a sufficient optical contrast is required. Regarding material-correlated authentication, ellipsometric quantities are taken for encoding. It has been shown that Fabry-Perot layer stacks are very promising candidate systems for authentication. Modified Fabry-Perot layer stacks provide material- and design-correlated physically uncloneable functions (PUF). This can be achieved by a multi-material and multi-parameter deposition approach as well as specific design features not subject to any reverse engineering strategy. Stack design and layer morphology can be varied in a way that interference, scattering and light diffusion result in various optical effects such as angle-dependence, angle-independence and change of colour. By structuring the bottom reflector or patterning the metallic interlayer of the Fabry-Perot stack any bar code or biometric feature can be realized.

In addition to the human eye and bar-code or data-matrix readers, imaging ellipsometry is used for forensic encoding of substrate- or layer-based information. Object-in-object features are discussed in dependence on the stack design. As a result, Fabry-Perot layer stacks may be used at all perception levels (public, hidden, forensic, encoded forensic) in conjunction with imaging ellipsometry for authentication against product counterfeiting and related areas.

Keywords

Fabry-Perot layer stacks
stack-design
layer morphology
ellipsometric encoding
authentication