Colored multi-functional labels for authentication and traceability applications

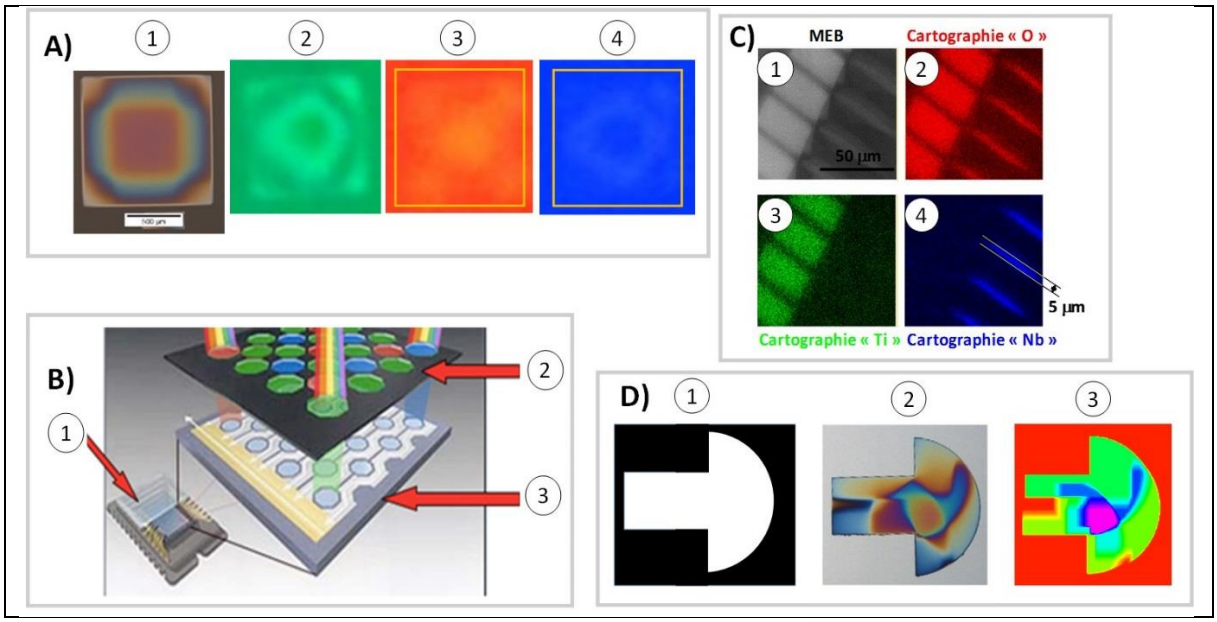
3D-Oxides is a SME specialized in developing structured oxide thin films for applications in very different fields (micro-electronics, photonics, biology, renewable energies, security, etc…). The deposition technique used is a disruptive technology that allows to obtain multi-element materials (up to 4) combined in very complex structures, both in terms of 3D topography and chemical composition (film thickness ranges from 10 nm to 5 mm with a 10 nm resolution, and pattern dimension varies between 200 nm and 1 cm, with a typical lateral resolution of 100 μm). The deposited structures demonstrate high added-value functionalities to be integrated into next generation chips.

A first prototype of a "security tag" was developed by the R&D. It is in form of a label to be affixed on products to ensure their traceability and authentication. The deposited multi-functional oxide label can be structured at different levels, and its reading can be achieved at different scales and can deal with different properties (optical, chemical, electrical, etc…). In parallel to patterns visible to the eye, the label hides other details that can be identified with more complex readers (such as SmartPhones) or even advanced scientific instrument for higher precision.

These tags can also be combined with an integrated reader in a device to provide cybersecurity and cryptography functionalities. Such a purely hardware solution enables to avoid the drawbacks of standard software solutions (energetic consumption, software size, etc…) to secure the information exchanged by connected objects. This information could first be authenticated, and then classified with the rules of an intuitive and self-organized semantic web.

The deposition technique used enables a low cost mass production of unclonable tags, all strictly different from one another. It therefore offers the opportunity to apply a high performance security solution even to low added value product ranges, though opening new market perspecyives.

The tag principle was patented by 3D-Oxides, which presently discusses the details of their implementation with its first potential customers. 3D-Oxides is presently searching for new partners to submit a FUI collaborative project aiming at adapting a turn -key solutions on other market sectors.



<u>Some pictures</u>

A) <u>Simple observation with an optical microscope :</u> (1) photograph of a 1*1mm^2 tag respectiveLy illuminated (1) with white light, evidencing different interference colors correponding to areas of different thickness, (2) with green illumination, (3) with red illumination and (4) with blue illumination (showing different pattern for different illumination)

<u>B) Use in a connected object :</u> the tag (2) is positionned on a camera (3) that provides the device (1) an electronic signature

C) <u>Scientific reading of a tag with a chemical mapping of the different elements :</u> a Nb_2O_5 :TiO_2 deposit observed with a SEM (1) shows mapping of the different elements : (3) Ti in the TiO_2 areas et (4), Nb in Nb_2O_5 areas and (2) oxygen for both oxides

D) <u>Tag variation</u> : example of a simple geometric aperture shape used to prepare tags. Depending on deposition parameters used, different patterns and colors are obtained. Example of such a deposit is presented in (2), with in (3) deposit simulation in these conditions, evidencing the good predictability and reproducibility of tag production.

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