OPTICAL SOLUTIONS

Dr Mark Deakes *considers integrated optical solutions and how they meet the demand for physical security applications among customers and end-users requiring sustainable solutions.*

A cornerstone of anti-counterfeiting solutions, holography has continued to evolve in the face of expanding market applications, security sector mergers and acquisitions and consolidation among solutions' providers. Today, it now features within a broader spectrum of optical security technologies that meet ever more intricate and nuanced requirements from agencies, central government banks and others with responsibility for law enforcement.

For instance, innovations such as micro-lenses, micro-mirrors, colour shifting, print and diffractive technologies all include holographic technologies that will no doubt continue to feature and adapt in the coming years as the demands placed on the security and authentication sectors grow. Plasmonics – the science of manipulating light at the nanoscale using metallic nanostructures – is a rapidly growing field with applications in many areas, including imaging, sensing and energy. Together with structured colour optical technologies, they are making progress as part of integrated solutions that could really take-off and see a lot of traction, particularly in the highly competitive bank note component market, which continues to pick-up in-line with the government ID market as well.

These latter optical technologies have emerged on the back of holographic and diffractive technologies over the last decade to become part of the natural evolution of optical science by R&D teams developing the next generation of security features for industry and commerce. Indeed, several existing IOTA members produce optical security features beyond holography, including SPARK Orbital by De La Rue. This colour-changing security feature, which is used on bank notes, is designed to help prevent counterfeiting. It works as a printed ink feature, acting as a reflective image over a transparent window in bank notes and when the note is tilted or moved, the image changes colour producing a feature that is visible from both sides of the note. So far, the technology has been adopted as an authentication and anti-counterfeiting feature on the Clydesdale Bank's £5 and £10 polymer bank notes, while the Royal Bank of Scotland's bank notes use SPARK Orbital to showcase the RBS logo. Other examples include KURZ's KINEGRAM DYNAMIC, which combines micro-lenses with sophisticated and proprietary production processes to create impressive deep-view, multi-coloured and dynamic movement when the feature is tilted.

Plasmonics and structured colour optical technologies look set to take-off in the bank note component market

Also catching the eye in the integrated optical security solutions' sector is Louisenthal's RollingStar LEAD (Long-lasting Economical Anticopy Device – a foil that covers the whole height of a bank note) micro-mirrors and colour shift devices – optically variable and dynamic effects packaged in a stripe, patch or thread for bank notes. Currently showing on billions of notes around the world, it combines two key security technologies: ColourShift and micromirrors, whose origination is defined by highly complex algorithms. The end result delivers a highly effective, eye-catching security effect to reassure both the public and retailers that the bank note in their hand is genuine and not fake.

We can also see in the highly competitive and technology fragmented product authentication and brand protection space products emerging that are a combination of many different optical technologies and digital. The march of digital of course will continue unabated and this combination of the physical and digital, or 'physi-digital', will push on – with recent merger and acquisition activity in the sector many organisations are increasingly able to provide not only physical protection of products with digital tracking capabilities, but also online brand protection as part of a more holistic approach. The proliferation of online counterfeits on many platforms is enormous with some analysts suggesting it could be worth around $1-trillion.

Strategic moves have strengthened the position of companies like SURYS, Hueck Folien and Authentix's in the pantheon of high-security and authentication sector innovators; offering an array of sophisticated, comprehensive technology solutions rooted in nano optic structures and colour-shifting materials, which specifically address the evolving needs of international security applications.

Authentix's core technologies, for instance, include the world's first nano optic, plasmonic OVD with 'always on' structural colour, 3D depth and vivid motion. This primary technology platform has been developed specifically around counterfeit resilience with nano scale origination, proprietary algorithms, specialised manufacturing processes and the use of non-commercially available materials, ensuring any reproduction is both prohibitively costly and virtually impossible.

Ease of authentication, durability – developing a technology that can withstand environmental effects to maintain trust in the security feature for the full lifecycle of the bank note – and integration are all added value features in core nano optic technology. These can enhance security and deliver authentication through innovative design with seamless integration on any substrate and skilfully designed to be applied by current industry equipment without the need for modification. The scale and range of this 'next generation' technology is designed to replace the aging micro-optic technologies, many of which are nearing maturity and obsolescence.

HOLOGRAPHY AND OTHER OVERT OPTICAL TECHNOLOGIES AREN'T JUST VISUAL DETERRENTS

Protecting ID has to be a priority for optical technologies, particularly in those global regions where the cost of issuing national or state IDs remains a dominant component – something that will undoubtedly continue for many years to come as governments look to control their budgets and wrestle with spending prioritises. That said, we are seeing continued moves to polycarbonate and the trend towards using full face optical devices over the ID card. Of course, the increased use and development of digital is relentless, but physical passports and ID cards will still remain the backstop of ID long into the future. KURZ is very active in this respect with its KINEGRAM technology. This facilitates the verification of physical and digital security features in passports, driver's licenses and ID cards, ensuring precise, proprietary security effects and intellectual combinations for protecting people's identities.

We are also witnessing the growing integration of proven technologies such as colour portrait and diffractive optical technology combining in the ID security sector to improve and ease authentication, for example IDEMIA's LASINK Helios. Here, the portrait is often the critical link between ID documents and their holders, providing security and validation benefits for both the issuer and the end-user. These type of cutting-edge DOVID optical effects have been designed to prevent multiple types of ID theft and fraud.

When considering integrated optical security solutions and how they meet the demand for physical security applications, it's important to mention sustainability in the face of challenges that grow ever more intricate. Sustainability must remain a priority among customers and end-users in the years ahead with the more prescient manufacturers increasingly investing in initiatives designed to reduce their carbon footprints as part of their corporate social responsibility strategies. Many former IHMA, who are now IOTA members such as Hueck Folien, KURZ and Uflex (not exhaustive), have invested significantly in green and recycling technologies.

Counterfeiting doesn't recognise international borders; it's an indiscriminate menace that impacts industries ranging from pharmaceuticals and FMCG to electronics and luxury goods. As criminals become more sophisticated, businesses and regulators must adopt ever more advanced security

measures to protect products and consumers. And this includes the integration of optical solutions with product traceability systems. Holography and other overt optical technologies are no longer simply visual deterrents; they have evolved into technologically advanced tools that work alongside digital traceability mechanisms to deliver authenticity, transparency, and trust. Traceability allows consumers, law enforcement, border control agencies and retailers to verify the legitimacy of products through QR codes, and labels incorporating optical features to deliver enhanced authentication and supply chain transparency through the identification of weak links that counterfeiters can target with their fake products and brands.

PHYSICAL PASSPORTS AND ID CARDS WILL STILL REMAIN THE BACKSTOP OF ID LONG INTO THE FUTURE

It also facilitates rapid product recalls by quickly identifying and removing counterfeiting or defective items from the market. Compliance with global regulatory standards such as the EU's Digital Product Passport and the FDA's Drug Supply Chain Security Act adds further legitimacy to traceability, particularly when you consider that global losses to counterfeiting exceed billions of dollars in lost revenue, damage to corporate reputation and R&D.

And what about the threat to optical technologies and OVD presented by AI, especially deepfake technology? What are the concerns? AI is both a huge threat but also a huge opportunity. If we look at the opportunities, optical solutions providers are already embracing AI to help them with design themes and concepts and even to develop new security features and coding. And of course, in digital authentication AI is already used in ID authentication and data analysis.

We are also mindful of the threat AI poses, in particular those technologies that are now freely available and that may cause significant harm to the sector if they land in the wrong hands. At the minute, the technology is developing at a rapid pace and legal frameworks and regulations are playing catch-up or emerging – for example, the recent introduction of the EU AI Act. The dilemma is the need to balance innovation with ethical safety considerations and guard rails. The other consideration here is intellectual property – some organisations have banned the use of AI in the workplace and in particular, in R&D and technical development functions.

It's clear that as security optical technologies continue to develop they need to remain relevant, evolve and push the application boundaries. The challenge for the R&D teams and manufacturers is to look at the emerging technologies and utilise their features and benefits to create the next generation of authentication and anti-counterfeiting technologies. It's therefore reassuring and exciting to see optical technologies now merging with digital solutions, delivering greater levels of optical security. It all paints a bright future and holography, plasmonics, micro-lenses, micro-mirrors, colour shifting, print and diffractive technologies all have a part to play as the key components in effective, added value, envelope-pushing solutions. ●

Dr Mark Deakes is chair of the International Optical Technologies Association (formerly the International Hologram Manufacturers Association).

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