RECONNAISSANCE
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Inside this edition

Meta's New Sustainable Brand Protection Label

Hot from successes in the 'Best Origination' and 'Best in Show' categories at the recent International Hologram Manufacturers Association (IHMA) awards, Meta Materials is bringing its expertise in advanced materials and nanotechnology to the field of brand protection labelling, with its new product – NANO™ protect.

According to company literature, NANO protect is the world's first nano-optic, plasmonic OVD brand protection label and offers 'always on' structural colour and movement. It comprises a blend of authentication optics, combined with design expertise, producing a security device with unique visual effects that is near impossible to replicate with other technologies.

One key advantage of NANO protect highlighted by Meta lies in its sustainable and environmentally friendly design. Manufactured without inks, pigments, or dyes, the security labels are built on a single layer of embossed material, making them one of the greenest security features available. The use of metamaterials enables NANO protect to achieve vivid visual effects while using only a fraction of the material compared to traditional micro-lens solutions.

The technology's flexibility is another feature, supporting various form factors and integrating with track and trace technology. Brands can reinforce their identity by customising multi-coloured designs and visual effects, allowing their unique story to be told through NANO protect's intuitive authentication.

The overt security features of NANO protect include multiple 3D elements, a broad colour palette, and omni-directional movement, ensuring easy and effective authentication across wide viewing angles and complex lighting conditions. The label's dimensions are customisable, offering a versatile solution for brand protection needs.

Underpinning NANO protect's commitment to sustainability is a secure production facility powered by renewable hydroelectric energy. The technology's minimal use of materials, elimination of laminated layers, and reduction of production variables all contribute to enhanced sustainable security, says the company.

As for covert security, NANO protect employs microtext, UV fluorescence, nano-imagery, tamper-evident features, and QR code serialisation.

New Members Boost IHMA Board

The International Hologram Manufacturers Association (IHMA) has announced changes to its executive board as it invests in strengthening its position as a leading authority on commercial authentication, ID security and packaging augmentation technologies.

The move sees Don Havourd, currently Head of Business Development at US-based Hazen Paper Company, elected to the board of the IHMA alongside Sebastian Amezquita Niño, a senior researcher and director at Combustion Ingenieros and Colombian Imaging Technologies in Colombia.

Sebastian Amezquita Niño (left) and Don Havourd (right).

The news comes as the IHMA continues to develop and expand its membership base, in particular to include more non-traditional members coming from outside the security and brand protection industries.

The next 12 months will see developments in new anti-counterfeit technologies contribute to the growth of holograms. These include micro-lenses, micro-mirrors and plasmonics, which all require new foils, different manufacturing processes and different originating technologies.

Welcoming Don Havourd and Sebastian Amezquita to the board, IHMA chair Dr Paul Dunn said: 'the IHMA continues to move forward and work with members and organisations to ensure that it remains a strong advocate, industry voice and effective resource for the industry in the future. I look forward to working with colleagues in 2024 and beyond, helping our industry secure growth and innovate, as well as ensuring all involved in holography come together as one to secure the opportunities available for growth.'

The other IHMA board members are currently Mark Deakes of ITW Security Division, Manoj Kochar of Holoflex and Ondřej Fedorčák of Optaglio.

New Technology Developments Lead Hologram Growth in 2024

Developments in new anti-counterfeit technologies will help support the growth of holograms in 2024, according to Dr Paul Dunn, chair of the International Hologram Manufacturers Association (IHMA).

Micro-lenses, micro-mirrors and plasmonics are among the rapidly emerging optical devices that have evolved on the back of holographic and diffractive technologies, and are seen as part of the natural evolution of optical science by R&D teams.

In turn, these technologies require new foils, different manufacturing processes and different originating technologies to get them fully to market and achieve commercial viability. This opens up more opportunities for savvy hologram manufacturers to secure additional market share and demonstrate how holography continues to secure new applications and remain a relevant technology.

However, in the coming months, manufacturers and their R&D teams will need to assess the viability of these nascent technologies and challenge themselves to come up with a new generation of authentication and anti-counterfeiting technologies for traditional applications.

Dr Paul Dunn said: 'what's clear is that the speed of technical evolution is increasing and developments in digital technologies are probably the most significant to impact the future of anti-counterfeiting solutions in 2024 and beyond – a view supported by many in the optical devices sector.

'We will continue to see optical technologies merging with digital solutions and greater levels of optical security by combining technology functions. I feel this presents a strong future with holograms continuing to be a key component, reflecting how they are evolving, developing, and finding new commercial outlets.'

Holographic authentication and track and trace systems will continue to help underpin international efforts by government and law enforcement agencies to bolster overt and covert protection strategies beyond the next 12 months.

Dr Dunn said: 'counterfeiting is a massive global threat, continually placing governments, brands, and the public at risk – and will continue to be tackled effectively to minimise the impact on society. Despite the continued economic, social, and global supply chain challenges, we expect to see growth in 2024 with countries enhancing and bringing forward their anti-counterfeiting plans which feature holograms.

'Again, these holograms will become even more integrated with other technologies to create intuitive brand engagement programmes while, simultaneously, authentication through scanning a QR code on the label acts as a secondary product verification method. This provides unified and easy-to-use platforms for brands to interact and engage with their customers.'

The convergence of physical and digital worlds – the metaverse – is also gathering pace, and investments are being made in metaverse-related technologies, including holographic display components that will play a significant role in bringing the metaverse to fruition, providing new ways in which people can share information, communicate, and embrace virtual worlds.

High security print applications will continue to increase, as holographic origination capabilities are brought in-house, cutting the innovation cycle, and allowing security printers to get their technologies specified for new banknotes.

Sustainability will also continue to be a priority in 2024, as manufacturers increasingly invest in strategies to cut their carbon footprint as part of their corporate responsibility strategies, with the IHMA leading efforts through its Sustainability Working Group to encourage best practice.

Dr Dunn added: 'as holography continues to develop to remain relevant and push the boundaries of possibility, the IHMA will remain at the forefront of the sector in 2024. We will continue to evolve like the exciting technologies we represent to ensure the interests of members and manufacturers are to the fore and their voices heard'.

To learn more about the benefits of IHMA membership, visit https://ihma.org/.

Researchers Develop 360-Degree AR Holographic Automotive Display

Researchers from the Universities of Cambridge, Oxford and University College London have developed an advanced augmented reality (AR) holographic system that projects 4K video using LiDAR point clouds, specifically designed for automotive head-up displays.

According to the developers, the technology will significantly enhance road safety by displaying real-time, 3D holographic images that align with real-world objects in both size and distance, providing drivers with a comprehensive view of potential road hazards.

The system utilises light detection and ranging (LiDAR) data, transformed into detailed 3D images, and leverages GPU-accelerated computing to create holograms faster than traditional CPU processing. This offers an augmented view of the road, maintaining the driver's focus and reducing the risk of accidents due to human error.

Unlike existing 2D head-up displays that project onto a small part of the windshield, the 360-degree technology is intended to keep the driver's eyes focused on the road. The 3D projections provide information about hazards from any angle in the driver's field of view without being distracting or overwhelming.

Below is a visual demonstration of the technology.

a) Point cloud-extracted data with a separation algorithm, which is post-processed into a computer-generated hologram and an intensity profile in the replay field result. Each point has an intensity value assigned.

b) The optical focusing lenses are reduced to virtual Fresnel lenses as part of the post-processing algorithm. The virtual Fresnel lenses are introduced at a focal length of f = 50mm and f = 75mm.

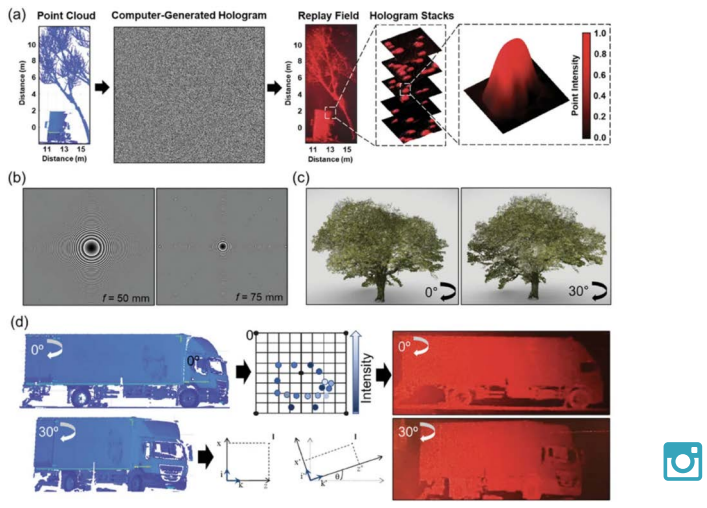
c) LiDAR object rotations with depth information as pixel intensity and depth information of the object to be displayed to the driver as a 360°-rotated fully assessable obstacle. The rotation process is shown at 0° and 30°.

d) 3D object rotation of the extracted LiDAR object and its corresponding replay field result: LiDAR truck presented at 0°, intensity map of the LiDAR object, replay field result; 3D object rotation around the y-axis, LiDAR image of the truck rotated at 30°; and replay field result.

The researchers used LiDAR to capture extremely detailed scans with up to 400,000 data points for a single object. Specialised data processing techniques extract only the most essential information to generate the holograms in real-time. This allows for a 360-degree assessment of potential obstacles on busy, constantly changing streets.

The data collected can also be stored and shared via the cloud to create a crowd-sourced platform that provides real-time hazard awareness for all vehicles passing through an area.

The researchers are now collaborating with Google to test the system in actual vehicles, with road trials potentially beginning in 2024. The team aims to develop an inclusive system to improve safety for all road users.



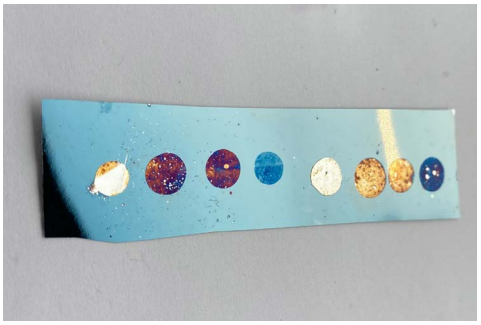
Depth information of the holography setup to recreate 360° floating 3D objects in the replay field (Source: Advanced Optical Materials).

Idvac Introduces Layer-by-Layer Nano-Etching Technique for Multispectral Colours

Idvac Ltd, based in Manchester, UK, has unveiled a ground-breaking method for fabricating bespoke multispectral colours using a layer-by-layer nano-etching process.

Traditionally, achieving vibrant colours involves pigments, inks, or printing. Idvac has developed an alternative approach with no print or inks used. The process begins with vacuum metallising a specially developed single optical coating onto a standard aluminium metallised film within a standard roll-to-roll vacuum web metalliser.

According to the company, what makes the method truly unique is the controlled chemical etching used for the layer-by-layer removal of 5nm of the coating. The result is a spectrum of bright colours, including red, blue, yellow, and silver. Laser dry etching can also be employed for precise removal, providing flexibility in the fabrication process. The effect is created as metallised aluminium acts as a mirror, reflecting the different colours produced through the etching process.



Idvac's layer-by-layer nano-etching sample showing various bright colours.

The applications of this technology are vast. Selective coloration of films finds utility in light filters, solar control windows, and security holographic documents. Idvac's latest development allows for the creation of a matrix of colours, which, when combined with holographic technology, can be incorporated into the core of blank security documents before lamination.

Under the leadership of Prof Nadir Ahmed, Idvac has been at the forefront of advanced metallising processes since its founding in 2004. With over 20 years of success, the company has introduced various vacuum processes and technologies, including HRI (ZnS), copper, red copper, SiOx, AlOx, silver, gold colour (no ink or pigments), colour shift. In addition to its colour innovation, the company has also developed a corrosion protection process to safeguard metallised copper from tarnishing.

ZEISS Showcases Multifunctional Smart Glass Technology

The optics and optoelectronics giant ZEISS has launched its Multifunctional Smart Glass technology showcasing the equipment and processes for mass production.

The technology permits the optical activation of transparent media combining four basic functions: projection, detection, illumination, and filtering, to open up new holographic possibilities, from smart home solutions through to augmented reality head-up displays (AR HUDs). ESA and NASA space missions have carried ZEISS' technology on board for many years. It is also well established in the semiconductor and medical technology sectors.

At the heart of the ZEISS technology is a thin, transparent layer to which ultra-high-precision optics are attached in the smallest of spaces, characterised by transparency of over 92% combined with maximum clarity. This makes it possible for holographic technology to be used in applications where limitations of installation space, weight and costs previously stood in the way. The holographic functionality can turn any glass surface (windows of buildings, transparent screens, side windows of vehicles) into an on-demand screen for communications.

According to ZEISS, the fully automated duplication of a master hologram in large quantities is now possible for the first time. Commenting on the development, Roman Kleindienst, Vice President ZEISS Microoptics said: 'this technological milestone for holography can be compared to what the invention of letterpress printing meant for writing. That's why we call it the 'Gutenberg moment' for holography'.

AR HUDs have many advantages in cars. Drivers obtain all the input they need without taking their eyes off the road, with the selected information displayed within their field of vision.

The holographic content also permits more design, branding, guidance, and information functions. Side and rear windows can be used for eye-catching Car2X communications. It is also possible to black out window glass or make projected text and images visible only from the inside or outside. Video content is also supported. According to the company, with the 3D imaging, the technology opens up new levels of design freedom for light signatures.

One example is the floating switches in vehicle cockpits or smart homes. These are holographic, 3D human-machine interfaces based on ZEISS' unique transparent layer. They allow 3D control elements to be displayed on demand as light projections in the form of switches or controls on clean black-panel surfaces, activated by voice or gesture control only when needed. This gives a clean, contemporary look to vehicle interiors or the controls of smart household appliances.

The technology also permits the integration of a transparent camera – a 'holocam' – that uses coupling, decoupling, and light guiding elements to divert incident light to a concealed sensor. This eliminates the need for exterior and interior cut-outs or installation space, in visible areas, for cameras or sensors to follow distance alerts or parking sensors, or for fatigue detection systems.

The holocam can also be used in entertainment electronics products such as screens and displays that have integrated cameras. Placing the holocam at the centre of the screen will allow participants in videoconferences to make eye contact. The transparency of the holographic layer has only a minimal effect on the brilliance of the image reproduction.

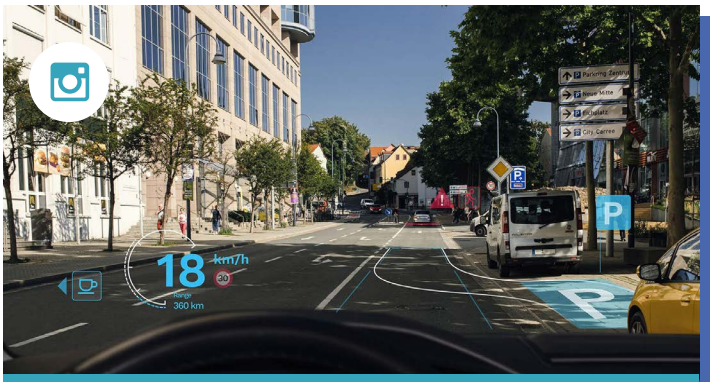
It is also possible to detect spectral components as additional information to complement the visible image. The resulting data provide insights into environmental contamination such as air pollution and UV exposure.

Other applications can be found especially in the smart home. Innovative interior lighting can be realised through special holographic decoupling elements in exterior glass that is almost indistinguishable from natural light. Windowpanes can be illuminated evenly over wide areas – with adjustable lighting moods to complement existing smart home solutions.

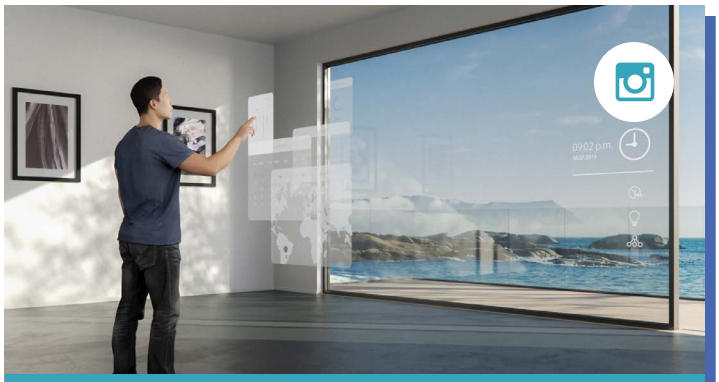
Glass surfaces can also generate energy. The micro-optical layer in the window pane absorbs incident sunlight and transmits it in concentrated form to a solar cell. This combines the advantages of conventional windows – natural light and an unrestricted view – with the additional benefit of efficient energy production.

As a result, says ZEISS, the technology will make surfaces available for power generation in the future that could not previously serve that purpose. These include office building facades and windows of high-rise apartment buildings and other residential housing, creating new opportunities to capture energy anywhere where glass panels are used.

As a system provider, ZEISS does not offer components manufacturing. Instead, it will provide the industrial-scale replication of holograms in the form of a transparent layer to manufacturers or suppliers who are looking to enhance their products and provide them with new functions. The company offers an entire ecosystem: from the first step through to the finished hardware, along with advisory services and design support.



Holographic AR HUD based on ZEISS Multifunctional Smart Glass technology.



Window Pane Integrating ZEISS Multifunctional Smart Glass Technology.

Holograms on Banknotes

In this episode of the Holograms on Banknotes series, we report on the latest issues from the United Arab Emirates (UAE), East Caribbean and Tonga.

Mixed New Series for Tonga

In December, the National Reserve Bank of Tonga (NRBT) launched a new series of banknotes to coincide with the birthday of the late King Tupou 1, the first ruler of modern Tonga.

The notes, which replace the 2015 series, were designed and printed by De La Rue, and are in six denominations, ranging from 2 to 100 pa'angas (T$). The two most heavily used notes – the T$5 and T$10 – are on SAFEGUARD® polymer, with a transparent window incorporating an image of the current king, Tupou VI. The other four notes are on paper.

The highest denomination (T$100) features an 18mm wide NEXUS micro-optics thread, the T$50 an IGNITE® dynamic micro-optic thread, and the T$20 a PUREIMAGE™ holographic thread on the $20 note.

Master Blaster Graces New ECCB Note

Also in December, the Eastern Caribbean Central Bank (ECCB) issued a new denomination $2 commemorative banknote in celebration of its 40th anniversary.

Printed by De La Rue on SAFEGUARD, the note joins the all-polymer series first introduced in 2019 and is one the first 'next generation' polymer banknote designs, with a deep integration of complementary security features into the overall banknote design.

It showcases a portrait of the legendary cricketer Sir Vivian Richards, affectionately known as 'the Master Blaster', who is one of cricket's most revered batsmen. Ruby red elements within the portrait honour the milestone anniversary.

The portrait aside, the main design of the note is an intricate aquatic ecosystem, representing the Caribbean's thriving marine life.

The banknote's visual impact is enhanced by features including an aqua-blue tinted holographic foil stripe depicting a turtle and other marine life, along with the denomination numeral.

The note is legal tender and can be used for transactions throughout the eight member countries of the East Caribbean Currency Union.

UAE's New Note Celebrates Sustainability

The Central Bank of the United Arab Emirates (CBUAE) has issued a new 500 dirham (AED) note – the fifth in its new all-polymer series, which has been progressively rolled out since 2022.

The banknote was printed by Abu Dhabi-based Oumolout on SAFEGUARD® polymer, and its introduction on 30 November coincided with both the UAE's celebrations of the 52nd National Day and with the COP28 Summit, which the country hosted.

According to the CBUAE, the banknote's design encapsulates the country's journey in sustainability, its pioneering development approach, its global role, its track record of climate action, and its continuous commitment to advancing sustainable solutions.

The main image on the front of the note depicts the Terra Sustainability Pavilion in Expo City Dubai, while the reverse highlights the Museum of the Future in Dubai. Also prominent on the reverse is an image of iconic landmarks, namely Emirates Towers and the Burj Khalifa, which – at 828 metres high – is the world's tallest building and is powered by solar energy.

The choice of polymer is in keeping with the country's drive to sustainability, the CBUAE says, given that it is two or more time more durable than traditional banknote and is fully recyclable.

In common with the AED 1,000, which was issued in April 2023, the new banknote features KURZ' proprietary top-to-bottom stripe multi-coloured, registered KINEGRAM COLORS® foil stripe. This stripe, depicting the late and revered Sheikh Zayed bin Sultan Al-Nahyan, is strategically applied over a large transparent window within the polymer substrate. His portrait is also included in a second clear window.

Gietz Gets New Management Team

In a strategic move aimed at steering Gietz AG towards continued success and innovation, Hansjoerg Gietz, after years of service as Managing Director, has announced the transition of leadership to Marcel Gerber – currently serving as Engineering Director – with effect from 1 January 2024.

Hansjoerg Gietz, whose leadership has played a key role in establishing Gietz AG as a prominent player in print finishing, packaging, and security printing, will now focus on guiding the company's strategic vision in his capacity as Chairman of the Board of Directors.

The company will be best known to readers of Holography News® for its early work on the application of registered holograms on banknotes. Today its machines meet the requirements for applying all types of security films, including holograms, OVDs, micro-mirrors and lenses. Based on many years' experience in applying holograms to banknotes, the company now covers the entire range of security needs: ID cards, visa stickers, passports, tax stamps, as well as other types of government secure documents.

Last month, the company commemorated a remarkable moment in its history when the Japanese company Bihaku-Watanabe purchased the 100th Gietz FSA 1060 Foil Commander machine. The Foil Commander has established itself in all facets of stamping foil printing: in hot foil stamping, blind stamping and the application of holographic security foil. The machine can be customised using optional elements that can be retrofitted at any time.

The management team, under Gerber's leadership, will consist of Michael Grau (Head of Sales), Felix Kramer (Head of Engineering), Claudia Heer (Head of Finance), Daniel Sund (Head of Production), and Christian Casutt (Head of Service).

Hansjoerg Gietz and Marcel Gerber.

Then and Now – Financial Cards

By Francis Tuffy

In this series of articles using source material from historical and current issues of Holography News® (HN), along with a few other contextual sources, I have so far covered the development of commercial holography for use on banknotes, ID cards, head-up displays and the graphics arts industry. This month, I turn my attention to its use on financial cards.

Credit cards

From my perspective, the story of holograms on financial cards begins with credit cards – starting with a problem. In the 1970s, the use of credit cards started to gain widespread popularity, offering convenience for stores, efficiencies for banks and, if properly managed, cash flow control for consumers. This newfound convenience came with an unintended consequence: a surge in counterfeit cards and fraudulent activities. Financial institutions were faced with the daunting challenge of ensuring the integrity of their payment cards.

In response to this growing threat, holograms were introduced to credit cards as a security measure. In 1983, Mastercard was the first to use the hologram as a security device on a financial card. The hologram was first used as an anti-counterfeiting device, but it soon became a design tool to help make the cards more aesthetically pleasing and competitive in the market.

Prior to 1983, the credit card industry saw counterfeit fraud double each year, with Mastercard losing $9.1 million in 1982 alone. In the period 1983-87, Mastercard saw its counterfeit fraud actually reduce by 75%. In an October 1991 HN interview with Tom McGraw, Mastercard's Director of Technical Operations, he asserted: 'some of our major competitors who were critics in the beginning soon adopted the hologram for their card design and realised comparable results'.

He also warned that the quality and effectiveness of counterfeit credit card holograms was improving. He clearly gave notice to the industry that the technology behind security holograms needed to improve to stay ahead of counterfeiters.

The March 1992 edition of HN proved Tom's predictions to be correct, when forged Mastercard and VISA cards, with counterfeit holograms good enough to fool merchants and retailers (the acid test) began to emerge in significant volumes in the Far East. The holograms appeared to be embossed from recreated artwork which required sophisticated laser origination, electroforming and embossing operations.

According to reports at the time, the images were very close to the genuine hologram, although close examination revealed some flaws in the design. This particular group of counterfeits represented the fourth generation of counterfeit holograms on credit cards, with all earlier versions being obviously flawed and easy to spot.

Holomagnetics

In November of the same year, HN reported the launch of Holomagnetics, a new credit card security system comprising an embossed hologram laminated to a magnetic ribbon, with encoding and reading assemblies. It was a collaborative venture between American Banknote Holographics, Control Module, and LEONHARD KURZ.

As a replacement for the standard magnetic strip, Holomagnetics was a machine encoding and reading system designed to verify the validity of the card. In particular, it was intended to prevent the copying of data from the magnetic stripe on a valid card to a stripe on a counterfeit or fraudulent card – a practice known as 'skimming'. It was also seen as meeting the increasingly important requirement of machine readability.

Some years later, Holomagnetics fell out of favour for credit card use. In HN May 2006, VISA explained its decision to stop using the technology. Quoting from an interview published in sister publication Authentication News®, Karen Gullett, Senior Vice President for Global Brand Management, explained that the new VISA branding programme, of which the HoloMag stripe was an integral part, went live in September of 2005 in various locations, primarily outside the US.

By the end of the year, VISA was receiving a limited number of reports that some of the new cards with the 'shiny silver stripe' were not working for merchants. In some of these cases, the card was causing terminals to 'freeze', requiring a terminal reboot. VISA dispatched teams into the field to analyse the problem and eventually narrowed the cause to electrostatic discharge from the stripe. Despite the removal of HoloMag from the card, VISA directed issuing banks to continue to use the 'Dove' hologram.

The VISA Dove and Mastercard Globe holograms still appear as branding elements on their respective cards but have been relegated to the back.

Phone cards

Before the ubiquity of the mobile phone, calls made from outside the home would have been made from public telephone boxes using mostly public sector telecoms networks. In earlier times, there was one payment option: coins. But as telecoms markets started to deregulate in the early 1980s, new entrants to the market brought new ways to make calls on-the-go and a range of ways to pay for them.

One method that gained popularity, for a while, was a stored value or phone card. These cards had a unique identification number that was used to access and authorise the usage of prepaid phone services. The protection of the number on a phone card was essential to prevent unauthorised access and misuse of the prepaid balance.

For a limited time, there was a bubble of activity in the commercial holography sector for the production of holographic scratch-off material to protect the PIN on phone cards. The December 2003 edition of HN reported that Alpha Lasertek (India) and De La Rue Holographics & Tapes (UK) had joined Pura Barutama (Indonesia) to produce scratch-off holograms as a more secure replacement for the usual grey latex-based ink.

De La Rue had already positioned its products for the brand protection and telecommunications sectors, while Alpha Lasertek was aiming at the phone cards, gift voucher and lottery ticket markets. Pura had a range of products specifically developed for pre-paid phone cards that

Continued on page 8 >

Plasmonic Metasurfaces Produce Print and Holograms Simultaneously

In the realm of optical technology, a new process is emerging that uses ultrathin plasmonic metasurfaces, capable of simultaneously enabling full-colour printing and holography on a centimetre scale. These metasurfaces leverage photonic spin–orbit interactions excited by surface plasmon polaritons (SPP), opening the door to a new era of high-security applications and mass-produced optical devices.

Traditional metasurfaces, composed of subwavelength structures, have already demonstrated their usefulness in manipulating fundamental properties of light such as amplitude, phase, and polarisation. This has led to the development of various optical devices, including holograms and prints, both looking promising as next-generation optical security and storage solutions. However, achieving simultaneous control of phase and amplitude for large-scale, full-colour printing and holography has been a challenge.

In research conducted across three science academies in China and published in a paper titled 'Simultaneous Full-Color Printing and Holography Enabled by Centimeter-Scale Plasmonic Metasurfaces'[1], a proposed ultrathin plasmonic metasurface overcomes these challenges by employing photonic spin–orbit interactions excited by SPP within a narrow spectral band.

This narrowband response not only facilitates high-purity colour generation but also minimises crosstalk among hologram channels, ensuring the integrity of the holographic images. The metasurfaces encode a full-colour image and three holographic images onto a single metamark, offering versatility in both printing and hologram modes.

Under incoherent white light, the centimetre-scale metasurface appears as a polarisation- and angle-encoded full-colour image, allowing flexible control over hue, saturation, and brightness. In coherent laser illumination, it transitions to multiwavelength holograms, demonstrating the dual-mode capability of the metasurface. This duality is a significant step forward, considering the difficulties faced by previous attempts to achieve both full-colour printing and holography on a large scale.

The key advantage of these plasmonic metasurfaces lies in their ultrathin design, enabling cost-effective mass production processes. The extremely shallow functional layer makes them suitable for surface plasmon lithography and coating processes, both of which are known for their efficiency and scalability. This paves the way for applications in high-density optical storage, holography, displays, and more.

Proof of concept

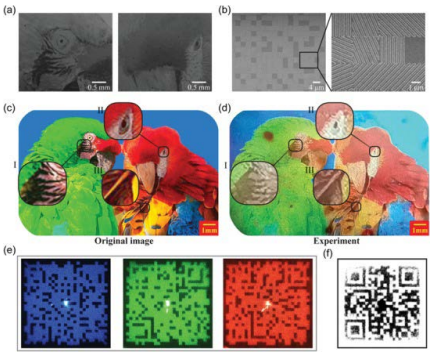
The proof-of-concept metamark, measuring 1mm × 1mm, encodes a picturesque landscape in the print mode and three distinct images of cartoon images in the hologram mode. Each pixelated plasmonic spin-grating (PSG) in red, green, and blue contributes to a specific hologram channel, forming a vibrant tricolour printing image.

Under incoherent white light, the holographic phase modulation is effectively ignored, and the rotated PSGs act solely as amplitude-modulating colour pixels, revealing the desired printing image.

Optical microscope images using halogen lamps demonstrate accurate colour reproduction, with minimal noise attributed to previous factors.

Upon illumination with coherent laser light, the metamark transitions from print to hologram mode, unveiling independent diffraction patterns for each hologram channel.

The measured total efficiency, approximately 48.2%, slightly lower than simulated values, is attributed to black areas representing about 10% of the metamark, which contribute nothing to the holograms.



Simultaneous Full-Colour Printing and Holography, published by WILEY-VCH Verlag GmbH & Co, KGaA, Weinheim.

Future applications

The proposed metasurfaces might also find applications in high-security domains, offering a platform for embedding multiple types of independent information into a single metamark. This includes information encoded in light parameters such as amplitude, phase, and polarisation. The metasurfaces show promise in anti-counterfeiting measures, information security, and other areas where multifunctional optical devices are in demand.

1 https://pubmed.ncbi.nlm.nih.gov/32440472/#full-view-affiliation-1

OpSec and Investcorp Europe Acquisition Corp I Secure Investment

OpSec, provider of holographic foils, IP management and brand protection solutions, and Investcorp Europe Acquisition Corp I, a special purpose acquisition company, have announced a strategic investment from SAKATA INX Corporation in the form of unsecured convertible loan notes issued by OpSec.

In April 2023, OpSec and Investcorp Europe entered into a definitive business combination agreement that would result in OpSec becoming a public company. Upon closing of the proposed business combination, the newly combined company will operate as OpSec Group and will trade under the symbol 'OPSC' on NASDAQ. The loan notes will convert into ordinary shares of the newly combined company in conjunction with the closing of the proposed business combination.

Selva Selvaratnam, CEO of OpSec, said: 'we are excited to further solidify our strategic alliance with SAKATA INX and truly appreciate their partnership and investment in support of our public listing. We look forward to years of collaboration as we develop market-specific solutions to protect our customers' brands'.

Yoshiaki Ueno, President and CEO of SAKATA INX, said: 'we are grateful to have had this opportunity with OpSec and look forward to deepening our relationship as we work together to provide our clients with comprehensive brand protection solutions'.

...Then and Now – Financial Cards

were used by phone service providers in Indonesia, producing over 5 million cards monthly.

These scratch-off holographic foils offered more protection for the PIN number (which could equally be used on vouchers or lottery cards) than latex inks. The challenge was to prevent reading of the number by removing the coating and re-covering it, which could be done relatively simply with basic printing equipment. As transaction instruments carrying a monetary value, these financial cards were susceptible to tampering, unauthorised access and removal of the data, which the telecom companies were keen to prevent.

Today, sophisticated billing mechanisms aggregate the cost of calls made across different networks, negating the need for phone cards, but the holographic scratch-off technology developed at the time can still occasionally be seen on vouchers and lottery cards.

Cheque guarantee cards

Another financial card that has now largely disappeared but, as an article in HN's September 1989 edition records, was important for building public acceptance of holograms as a security device, was the cheque guarantee card.

These cards were introduced to minimise the risk of bounced cheques and provided merchants with assurance that the amount stated on the cheque being presented would be honoured – up to the value of the guarantee. It was issued by banks or cheque guarantee companies.

In the late 1980s, British banks launched two new cheque guarantee cards featuring holograms on both the front and back of the card. The new cards were a response to consumer pressure on the banks to increase the sum guaranteed by these cards, which had been held at £50 for over a decade. A three-tier system was introduced, with the two new cards for guarantees up to £100 or £250 issued by special application only.

The holograms were designed and supplied by Applied Holographics (now Opsec) on foil from Crown Roll Leaf. At 18mm x 10mm, the 2-channel holograms featured a background image of the '100' or '250' denomination, as appropriate. At the top of each was a small seal of Shakespeare's head, a visual reference to the hologram used on the front of APACS' (Association of Payment and Clearing Services) cheque guarantee card. The card's denomination was image-planed on the surface for easy legibility in poor light, while the figure was a real image in the second channel. In a further differentiation, the '100' hologram was on silver foil and the '250' was on gold foil.

Advancements in electronic payment methods and increased use of credit and debit cards have diminished the use of cheques significantly in recent years – and consequently the need for cheque guarantee cards. But the introduction of holograms on the cards not only bolstered fraud prevention but also served as a visible symbol of technological progress in the financial industry. As a result, consumers, merchants, and financial institutions gained confidence in the use of holograms to protect financial transactions, setting the stage for further advancements in the use of holograms as a security technology.

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