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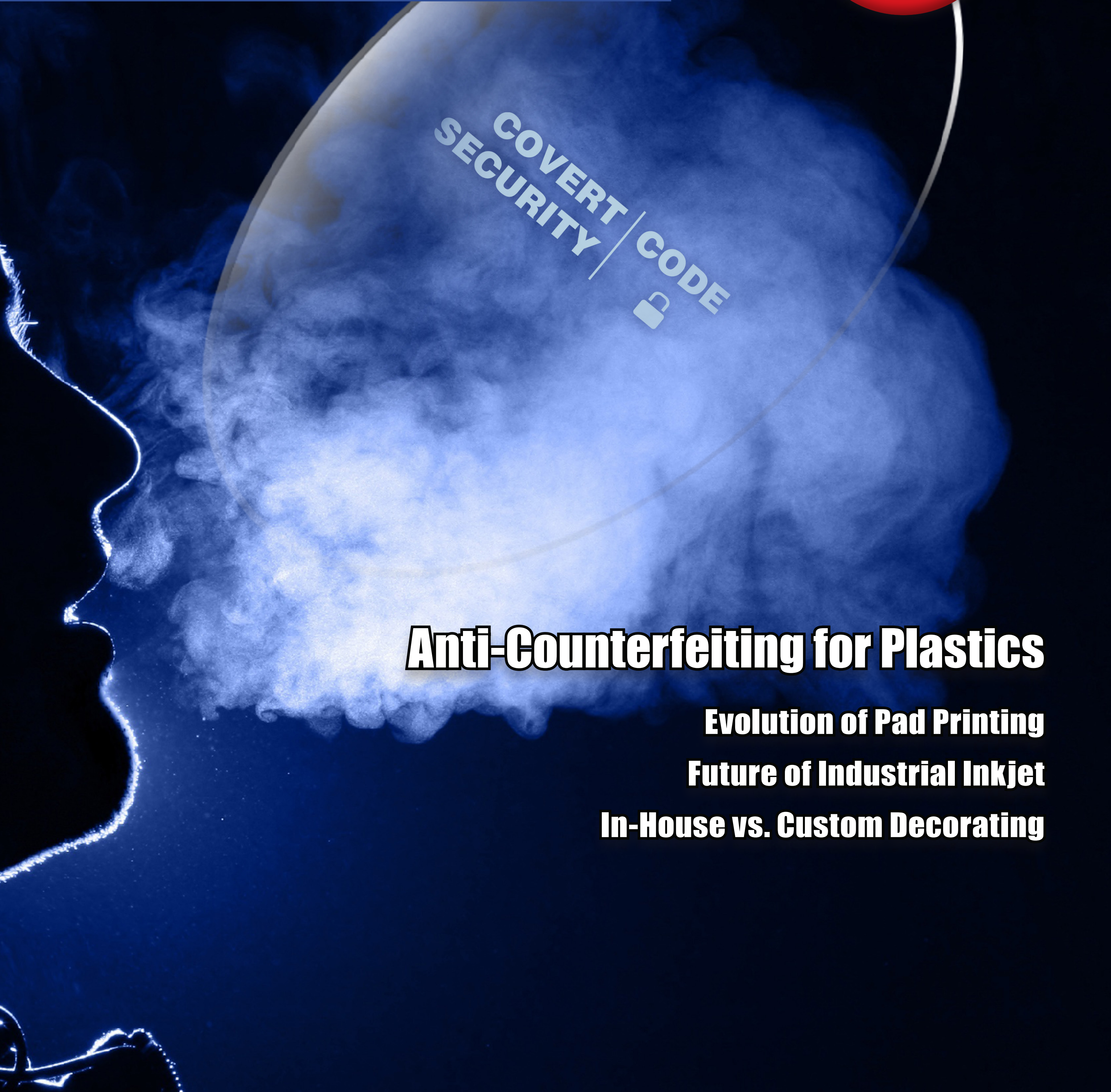

Anti-Counterfeiting for Plastics

Evolution of Pad Printing

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Breakthrough Anti-Counterfeit Technology for Plastics Products

by Scott Sabreen, president, The Sabreen Group

The Global Brand Counterfeiting Report 2018 states the amount of total counterfeiting globally has reached to $1.2 trillion in 2017 and is bound to reach $1.82 trillion by the year 2020, which includes counterfeiting of all equipment and products from military defense to consumer goods. As per the 2017 report, the amount of sale of counterfeit products through e-commerce platform is $280 billion[1]. Counterfeiting threatens the global economy and public health through the production of inferior products that circumvent consumer protection regulatory channels. No single anti-counterfeit technology can effectively protect all products and circumstances. A layered approach that combines multiple features into the product and packaging works best. This tactical methodology is ideal for plastic products that have value-added decorating and finishing. This article introduces a new anti-counterfeit technology and examines three levels of authentication security for plastics products.

Introduction

Authentication technologies are critical for supporting brand strategies and reducing the risk of fraud. Anti-counterfeit features enable the authentication of an item and function as a deterrent to anyone considering counterfeiting a product based on the difficulty or cost involved. The growth in counterfeit products can be attributed, in large portion, to the fact that counterfeiters employ sophisticated technology in manufacturing and packaging their fake products. Some operate entire production plants. Despite this epidemic problem, there are currently no global standardized anti-counterfeit identification criteria, and efforts to tackle counterfeits have focused primarily on making packaging difficult to imitate. It is imperative that new and more sophisticated technologies be introduced in the war against counterfeit. One new covert optical security technology, Snowleopard, is presented below.

Anti-counterfeiting technologies

Security features can be divided into three levels, i.e., Level 1 Security (L1S) (Overt), Level 2 Security (L2S) (Covert) and Level 3 Security (L3S) Forensic. These three levels of security in combination provide comprehensive, layered security protection solutions. Figure 1 highlights authentication features examined in this article, i.e., optical security, security printing, security inks and chemical taggants.

Overt and covert security authentication features are effectively incorporated into layered protection. Overt techniques are

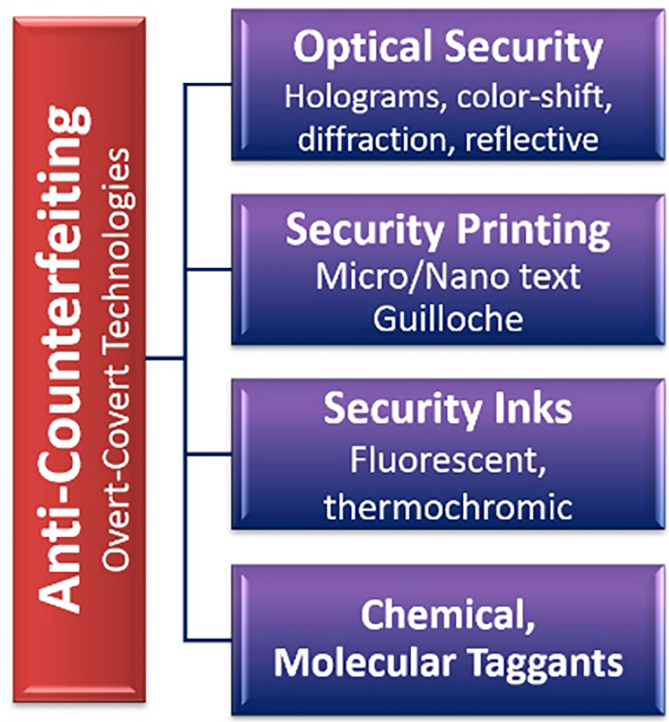

Figure 1. Anti-counterfeiting overt-covert technologies

clearly visible and do not require detection devices. Covert technologies typically require specific equipment to be verified, as the details of the technology are not disclosed. Most of the recent developments in overt and covert technologies have embedded hidden features to make them more difficult to be illegally replicated.

Featured technology – optical security (covert)

A new, state-of-the-art covert technology – Snowleopard – has been introduced whereby submicron microstructures “image/logo/text codes” are permanently etched into polymers, thin-films, metals and glass products. Polymer materials can be transparent, translucent or opaque (any color). Authentication, by way of an invisible security code, temporarily appears when vapor is applied by mist and rapidly disappears in seconds as moisture evaporates (Figure 2). No authentication instruments are necessary.

This covert feature is deployed worldwide in specialized applications in which authentication is simply performed via “vapor breath,” and is ideal for companies requiring brand

Figure 2. Permanent, invisible micro-etched codes temporarily appear when vapor is applied by mist, then rapidly disappear as moisture evaporates (left and middle). At the right is a vapor mist example. Photos courtesy of The Sabreen Group.

protection in underdeveloped countries. The technology is easily integrated as stand-alone or part of a layered defense. Submicron security codes are etched into the molded product itself. Alternatively, codes can be etched into tamper-evident security labels.

The process is non-contact and conducted at atmospheric conditions. No inks, solvent chemicals, films, labels or lasers are involved. The delivery format is performed inline or offline. Tabletop-sized industrial equipment requires only electricity.

A second example of optical security authentication is optical variable devices (OVDs). OVDs are complex security images

Figure 3. Example of OVD (Courtesy of Kinegram® security device by OVD Kinegram AG)

that exhibit various optical effects depending on the amount of light striking the OVD and the angle in which the OVD is viewed. OVDs cannot be photocopied or scanned and cannot be accurately replicated or reproduced. Many features have 3D effects and color-changing properties. OVDs, similar to holograms, generally involve image flips or transitions, color transformations and monochromatic contrasts. The construction is typically composed of a transparent film (as the image carrier), plus a reflective backing layer, which is typically a very thin layer of aluminum or copper, to produce a feature characteristic hue.

Additional security features may be added by the process of partial de-metallization, whereby some of the reflective layer is chemically removed to give an intricate outline to the image. The reflective layer can be so thin as to be transparent, resulting in a clear film with more of a ghost reflective image visible under certain angles of viewing and illumination.

For plastics products, a powerful layered defense strategy combines OVDs (holograms) with submicron etched codes (via Snowleopard) to create tamper-evident security labels. Submicron codes can be etched into the product and/or a feature in the OVD label. Secure adhesive labels have specific text built into the layered self-adhesive construction and, when peeled or removed, they exhibit the word “VOID” in both the removed film and the adhesive layer left behind. The text “VOID” could be replaced by customers’ brand, logo or message. Layered substrates – commonly polyester or biaxially-oriented polypropylene (BOPP) face materials – gain significance since they can be uniquely customized with infinite color combinations and metallization.

Security printing technologies: micro printing and nano laser marking

Micro/nano printing, including laser engraving/marking, utilizes single-point font sizes with ultrahigh resolution designs.

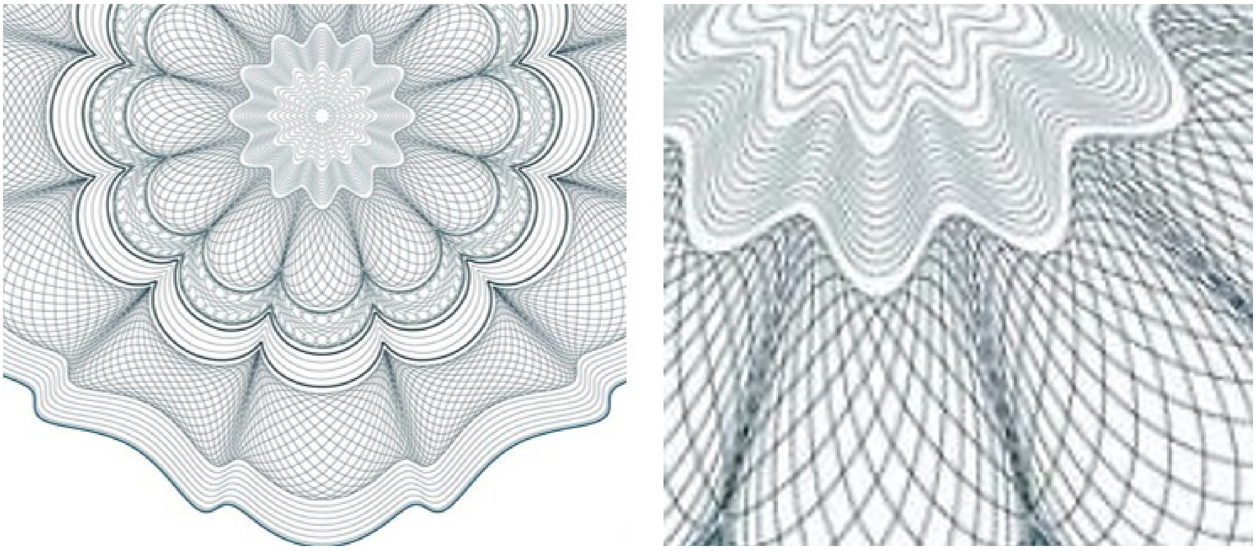

Figure 4. At the left is guilloche via pad printing. The image at right is magnified.

One example is guilloche printing, intricate and complex geometric patterns that consist of numerous interwoven fine lines (see Figure 4). Each pattern is uniquely generated, therefore exact reproduction is nearly impossible. Effects are often combined with rainbow coloring.

Security ink technologies include: UV-sensitive inks, thermochromic, photochromic, luminescent, fluorescent, iridescent, phosphorescent, etc. UV- and fluorescent-sensitive inks are available in various colors and glow under different wavelengths of UV light, while invisible to the naked eye. For example, a pad, screen or gravure printed thermochromic ink graphic/logo will change color (discoloration reaction) simply by rubbing a finger on the printed area. Each secure ink chemistry, utilized alone or in combination, combined with security printing technologies offers powerful authentication.

Nano laser engraving/marking

On-product marking by laser of micro/nano text is so small – less than 25 microns high – it is invisible to the naked eye, thus incredibly difficult for counterfeiters to replicate without the original artwork files. Microtext is frequently hidden in an inconspicuous or unnoticeable area on the product. Laser-engraved data and images are permanent and secure. When the item is placed in a photocopier or scanner, the line of microprint text will appear to the scanner as a dotted or solid line if the scanning resolution is not exceptionally high.

Additionally, laser marking produces raised lettering that can enable authenticity at the touch of a finger. Camera vision systems ensure accurate placement of data. Sometimes an easily overlooked spelling error is inserted in the micro text. Microprinting can serve to confirm the fact that the product is genuine. Laser waveguide types and configurations – such as UV, CO_2 and ytterbium fiber – including pico/femto, are commonly used.

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Chemical, molecular taggant technologies

Taggants, originally developed by 3M, can be added into molded plastic components and finished goods. Taggants do not change the color appearance of the plastic and can be used in any color, including transparent plastic. A taggant is one of the strongest protective measures, as few materials can be used within products without changing material properties and functions. Multiple taggant types are available to deploy and enforce strong and viable brand protection strategies.

One of the most significant recent advancements is product authentication using smartphones. Taggants, microtaggants and nanotaggants are uniquely encoded for each customer or product. Particles are microscopic, typically ranging in size from 20 microns to 1,200 microns. Each particle is uniquely encoded, essentially serving as a virtual fingerprint.

In its most basic form, the taggant is a unique numeric code sequence in a multicolored layer format. In more complex form, it provides multiple layers of security through incorporation of several nanotaggant technologies in a single microscopic particle. Verification and detection are done with a variety of inexpensive handheld readers and scanners, including smartphones. The taggants are available in dry particle form for compounding or as a finished masterbatch. The taggants can be used in a variety of plastic resins and colors with no change in processing conditions.

Conclusion

Counterfeiting threatens the global economy and public health through the production of inferior products that circumvent consumer protection regulatory channels. In response to this threat, new state-of-the-art covert technology – whereby submicron microstructures, image/logo/text codes, are permanently etched into polymers – offers innovative security options. A layered approach that combines anti-counterfeit technologies – overt, covert and forensic (taggants) – works best. This is ideally suited for captive and custom plastics manufacturers that presently conduct value-added decorating and finishing operations, or plan to.

This article presents anti-counterfeiting methods. Note, the comments and conclusions must be viewed as general to each group of technologies, and, inevitably, there will be exceptions with, and omission of, some more special applications. Some of these technologies are trademark brands and/or protected by international patents and may be available only from licensed suppliers, subject to fees. Alternatively, some can be applied in-house with costs on materials and processing, and most are available from specialist suppliers. ■

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