

Security Printing: Innovative Technologies with Comprehensive Approach as an Anti-Counterfeiting Tool

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Abstract— Technology has made remarkable progress with the time and touched new horizons in this 21st century. This technology proved to be a boon world widely for society. Despite of being achieving so many milestones with latest scientific inventions it have also affected adversely up to a certain extent. One among these adverse affects is 'counterfeiting or forgery' i.e. the biggest crime of this century. The crucial solution of this crux is 'Security Printing' as every problem has a solution. Security printing facilitates protection against counterfeiting and tempering overtly as well as covertly by combining numerous printing methodologies. This paper is intended to explicate the various dimensions of security printing, anti-counterfeiting tools and techniques used in modern era for improving credibility effectively.

Key words: Counterfeiting, Forgery, Security Printing, Overt, Covert, Printing Methodology and Anti-counterfeiting tools

I. INTRODUCTION

Security printing is blending of numerous printing methodologies providing protection against counterfeiting and tempering. In the other words security printing is unique combination of many printing processes in one process aiming at eradication of fraudulent duplicity or forgery made by counterfeiters in our society and enhancing credibility level among peoples significantly. Numerous combinations of printing processes and security aspects, especially when combined make it more difficult to be counterfeited. Also adding sophisticated secure elements helps in discouraging counterfeiters and forgeries. Different types of printing methodologies used in security printing include letterpress, offset, gravure, dry offset, screen and intaglio printing. Security printing substrates and security ink are the basic foundation of security printing and also play a crucial role during printing. The application of security printing can be categorized in two broad classes namely Credentials security and Product security. Credentials security is the specialization of printing technology and product security is associated with packaging aspects of products. In credential security consists of all the secure documents, certificates etc. Also currency printing is also considered an important aspect of security printing. On the other hand product security deals with the authenticity medium for both customer as well as brand of manufacturing company. Product counterfeiting risks consumer health as well as wealth. Also such type of forgery leads damaging brand reputation. So special emphasize is made for the security of credentials and product as well.

II. ADVANTAGES OF SECURITY PRINTING

There are numerous advantages of security printing process in combination with traditional printing processes. These are enlisted as:-

- Prevent forgery and tempering.
- Ensure security validation.
- Enhancing special features.
- Increase brand value/ product image.
- Improved quality standards.
- Ensure more credibility.
- Provides unique identity.

III. OBJECTIVES OF STUDY

The key objectives of this research article are to explore the different aspects of security printing terms of preventing forgery. Various aspects taken in consideration are: -

- 1) Anti - Counterfeiting Techniques
- 2) Security Printing as an Innovative Technology
- 3) Social Impact of Counterfeiting

IV. MATERIALS AND METHOD:

In order to cope up the various issues related to forgery, counterfeiting and duplicity various ways are opted which make it extremely difficult to counterfeit. Security printing is exploring multi-dimensionally and touching new heights in this modern era with the evolution of innovative technologies. Various anti-counterfeiting tools and innovative technology used in security printing are explicated as:-

A. Anti - Counterfeiting Techniques:

In order to prevent forgery numerous tools and techniques are employed for adding complexity. These features act as a significant barrier for counterfeiters. Security of any credential is achieved not only by printing technique merely but also through security substrates and inks. Anti-Counterfeiting techniques include authentication features, security paper, security printing inks and printing technology. Security inks and substrates are the foundations of security printing. These are elaborated as:-

1) Authentication Features:

In order to protect any credentials document or product package from forgery or duplicity some secure features are integrated with it for authenticity called authentication features. Various levels of authentication of security features include:

- 1) Overt (Level 1): Overt security features are also known as sensory features. These are those security features which can be recognized only by human senses and can be identified with little training without tools. Overt features are the easiest types of features to validate because these can be easily recognized. Such

features include Watermark, Color shifting inks, visible security threads etc.

- 2) Covert (Level 2): Covert security features are not sensory features and subjected to simple tool or detection devices in order to authenticate a credential. These security features required skilled examination and are extremely secure, hence hard from being counterfeited e.g. micro text, RFID etc. Some security features that requires electronic or digital medium for detection are also considered in level 2 security features like barcode, QR code etc.
- 3) Forensic (Level 3): These security features cannot be normally detected and require laboratory analysis by expert and trained specialist e.g. an ink tagged with rare material responding to very specific and particular light wavelength.

2) Security Printing Substrate:

Security paper is one of the basic foundation on which security printing underlies. Deciding the particular type of paper or substrate is as important as deciding what type of security feature to be embedded for any credential. Hence vitally of substrate cannot be ignored. Generally security paper is a heavy paper made from cotton fibers in order to foster the life and durability. Various types of security paper are:-

- 1) Safety Paper: This is heavy paper commonly used for currency printing. Its composition is heavily bitten cotton fibers for enhancing the life durability. Sometimes some specially color fibers are also added while manufacturing in order to differentiate it and preventing forgery. In some countries polymers are used as currency substrate in order to avoid wear and tear.
- 2) Water Mark Paper: A water mark is lighter or darker recognizable pattern made during the paper manufacturing by application of dandy roll. This pattern is the result of uneven paper density variations. Line drawing or shaded watermarks are prepared.
- 3) Copy Evident Paper: For protecting secure document this feature is incorporated. Because of this security feature original and photocopy of the document appear differently. Sometime photocopy of bank cheque display VOID.
- 4) Security Threaded Paper: Security thread or fibers are also incorporated while manufacturing security paper used for currency or financial documents. These threads are made up of metal foil or plastic often consists of micro printing.
- 5) Chemical Reactive Paper: Chemical reactive papers are used to protect secure documents against forgery and tempering. When paper is treated with chemicals it causes spot to appear indicating an attempt of tempering with.

3) Security Printing Inks:

Security inks are a special segment and another foundation of security printing. Its importance cannot be underestimated It is the security ink that fosters the credibility of security printing. Various types of security inks are enlisted as below :-

- 1) OVI: Its acronym is optically variable ink which consists of minute metallic film. When viewing angle is altered OVI changes its color depending upon the angle i.e. color shifts appears from one to other e.g. from Red to Green. These inks can be printed either Intaglio or screen printing.
- 2) Thermochromic Ink: Thermochromic inks are sensitive to temperature. These inks are reversible or irreversible color changing inks. For various temperatures these inks can be categorized under three categories namely low temperature (15°C), medium temperature (31°C) and high temperature (45°C) thermochromic inks. These inks are available for gravure, dry offset, offset, intaglio and screen printing.
- 3) Invisible Ink: These inks are invisible under normal lighting conditions. In order to detect these inks UV light source is required. Most widely used inks for security purposes and available in numerous colors.
- 4) Solvent Sensitive Ink: When someone attempts to alter any credentials then it shows a visible indicator and ink will run resulting smudged area. Such inks are sensitive to solvents.
- 5) Magnetic Ink: Magnetic inks usually consist of small magnetic particles which are machine readable. Such types of inks are usually used for serial numbering purposes.
- 6) Anti-absorption Ink: These inks are used for printing of security documents. Printed areas are visible under Infra Red light spectrum. These inks are available for letterpress, gravure, offset, screen and intaglio printing.
- 7) UV Fluorescent Inks: UV fluorescent ink appears to glow when exposed to ultraviolet light but under normal lighting conditions these inks are invisible. Both colored and colorless fluorescent inks are available for letterpress, gravure, dry offset, offset, screen and intaglio printing.
- 8) Biometric Ink: Biometric inks contain DNA taggants which are machine readable. These are completely covert requiring expert method for verification of authenticity.

4) Printing Technology: An Anti Counterfeiting Tool:

Security printing employs several different printing methodologies in order to maintain balance and production efficiency while producing credentials. It is almost unimaginative without the involvement of modern printing technologies. In other words, Security printing is the hybridization of many printing processes as unique process. Description of various printing techniques is delineated in table 1.

Printing Process	Features	Suitability of paper/ Substrate	Suitability of Ink	Pros and Cons
Letterpress Printing	Sharp edge printing, line and halftone block printing, Slightly embossed effect	Security paper can be printed, also suitable for thin and thick stock of paper	Oil based Ink e.g. in security printing numbering is done.	Versatile nature, inexpensive but not suitable for large size job.
Offset Printing	Smooth and even print,	Approx. 40 gsm to 200	All litho inks, UV	Good print quality on

	Fine quality of line and halftone printing	gsm, Security paper	curing inks Invisible inks, Thermo chromic ink	rough and cheap paper. Not suitable for small run.
Gravure or Intaglio Printing	High print quality near continuous tone	Equally suitable for paper as well as non-paper substrate	All gravure inks, Solvent and Water based ink, UV Curing, IR based ink	Print quality up to mark. More initial investment.
Flexography Printing	Fine halftone and tonal effect can be observed	Offer printing on paper as well as plastic substrates	Solvent and Water based ink, Thermo chromic ink, Invisible inks	Cannot print screen halftone as fine as offset printing.
Silk Screen Printing	More apparent ink density, Offers thick ink layer while printing	Suitable for heavier gsm paper usually because of single side printing	Screen printing inks, Invisible inks, Thermo chromic ink	Printing cost is low. Less durability and speed is slow.
Dry offset Printing	Offers high quality solid printing	Paper having gsm from 40 to 200 approx.	UV curing inks Invisible inks, Thermo chromic ink	Quality assurance but high initial investment.

Table 1: Description of Printing Technologies while Security Printing

B. Security Printing as an Innovative Technology

For blazing new trails in security printing and remain always a step ahead of counterfeiters, Security printing demands high degree of specialization. Therefore experts are working dedicatedly in this direction and have developed new security innovative techniques. Some of them are enlisted as below:

- 1) STEP Technique: It is the acronym for Shimmery Twin Effect Protection. This technique is generally based on the security ink feature. STEP is an optically variable ink that produces two different color effects while viewing from different angles.
- 2) INVISIO Technique: It is an invisible security feature incorporated in holographic printing. It can be identified with laser only.
- 3) FIT Technique: It stands for Fine Intaglio Technology. It is first-ever steel engraving method for producing ultra-fine lines. It offers creation of high resolution design and quality.
- 4) LEAD Technique: LEAD acronyms Longlasting Economical Anticopy Device. It is a shiny holographic feature for customer specification for preventing forgery.
- 5) PEAK Technique: It acronym for Printed and Embossed Anticopy Key. This technique is hybrid of intaglio and offset printing. An optically variable three dimensional image is made by fine lines by engraving and embossing. Effect made so is unable to be replicated by any color copier. Color and information changes with viewing angle and light direction.
- 6) INFACIO Technique: It repeats personal information like name, sir name, picture in UV fluorescent ink which is invisible in daylight and appears under UV light. It offers text manipulation and image replacement in identity documents.

C. Socio-Economical Impact of Counterfeiting

Counterfeiting is like an invisible enemy i.e. like cancer disease which is spreading its malignance among the society which will lead to disastrous consequences. So the adverse impact of counterfeiting is not constrained up to measurable limit but it is too vast to be predicted or assumed. It affects

multi proportionately. It effects economically as well as socially. Impact of counterfeiting as an evil can effect: -

- 1) Effect on consumers like offering duplicate products having poor quality.
- 2) Effect on economy of country by circulation of fake currency.
- 3) Effect on government in terms of corruption.

V. CONCLUSION

This paper has presented an overview about the various dimensions associated with security printing. Here it is elucidated how security printing approaches as innovative technology in terms of anti-counterfeiting tool. Security printing helps in retaining the credential free from forgery and counterfeiting. The new developments in technology have enhanced the quality and credibility in various ways. Security printing techniques ensure the security and effectiveness in the society. Different printing techniques act as a weapon in order to discourage the counterfeiters as each printing methodology offers a unique feature of printing. These technologies have emerged as anti-counterfeiting tools. In nutshell, the security printing has broadened the scope of eradication of duplicity and forgery with innovative technologies.

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