Guardian TMSubstrate As An Optical Medium For Security Devices

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ABSTRACT

GuardianTMsubstrate is a coated polymer film that has demonstrated its suitability as a substrate for variety of printed security documents. GuardianTMconsists of a transparent flexible polymer core layer that is coated on both sides with an opacifying coating that can be printed on using conventional printing techniques. Probably the most evolutionary feature of this substrate architecture is that it provides the facility to create areas on a document that are either transparent or semitransparent, depending on how the coating is applied. Now for the first time documents can be secured using devices that rely on transmission through a medium with high optical clarity. GuardianTMsubstrate provides the flexibility of varying the degree of opacity to suit the device being employed. This paper discusses the benefits of this important capability, using a number of new and adapted devices to demonstrate the potential of this new platform.
Keywords: GuardianTM,banknotes, security, optical, substrate, clear window, transparent

1. INTRODUCTION

GuardianTMsubstrate is a novel material that is used for the printing of security documents such as banknotes. The history of the Guardian TMsubstrate starts in the late 60's. It starts with the introduction of decimal currency in Australia when counterfeiting of the newly released banknotes was detected and recognised as a major issue. The Reserve Bank of Australia initiated a research program (that extended over two decades) in order to fmd suitable solutions to the problem. Diffraction gratings were chosen as one of the answers and after many trials and evaluations a new substrate that can carry such a device and explore its benefits to the maximum was born. Even in its infancy, the GuardianTMsubstrate had to satisfy all the requirements that standard paper was conferring to the banknotes as well as provide a transparent media (window) that will carry the diffraction grating. The current GuardianTMdoes provide the same basic functionality for the banknotes (and other security documents) with the added flexibility for exploring of new ways and techniques in security devices.

GuardianTMconsists of a transparent polymer core layer that is coated on both sides with opacifying coatings. This substrate architecture provides the ability to design documents that can have transparent, semi-transparent and completely opaque regions. Documents printed on GuardianTMsubstrate have the ability to combine traditional reflective security devices with transmission-based devices that require a medium with high optical clarity. This important property of the substrate has been utilised to develop a number of security features as well as to produce the classical features of the paper substrate. Figure I represents a cross section of the GuardianTMbased polymer banknote.

2. SUBSTRATE PROPERTIES

The core of the Guardian substrate is made out ofBOPP (Biaxially Oriented Polypropylene). This transparent polymer will confer on the finished product toughness and durability as well as the possibility for the incorporation of security devices that are compatible with a transparent medium. The opacified coatings are designed to suit customer requirements regarding design, colouration as well as carriers for some other security features. The degree of coverage of the opacifying layers may be varied to enhance the security rating of the substrate. For example, clear windows are created by no opacifying coverage and a shadow image is created by varying the opacifying coverage according to the design. The functionality of the shadow image is accomplished by the use of a combination of inks and design. A number of other security features may be designed in the opacifying layer that utilises the optical properties of the material used.

Using this type of material as a substrate for security documents, other traditional security printing processes can be applied in order to produce a document with a high security rating. These processes have been further developed to take advantage of the optical properties of the GuardianTMsubstrate. The perfect registration of the Simultan offset process provides the ability to print a see-through register device in the thin offset layer of a banknote. Intaglio printing is applied to the GuardianTMsubstrate in a similar manner as it is applied to paper substrate. This raised type of printing provides the banknote with a unique tactility and a number of security features. The substrate is flat in comparison to the conventional paper substrate. The flatness can provide the banknote printer with unique opportunities such as the use of highly reflective metallic inks that can enhance some of the standard security features and at the same time provide the background for new security features such as the TIDE feature.

The polymer banknotes are covered with two clear overcoat layers to protect the note from soiling and provide a feel. These extra layers provide the opportunity for a number of extra security features to be incorporated into the design.

The complex structure of the GuardianTMsubstrate provides the background for the incorporation for security features that can utilise substrate optical properties to the best advantage. Extensive research and development has been directed towards the enhancement of existing security features and the development of new security features. Security features that utilise substrate optical properties can be classified in the following major groups:

- Clear Window type security features
- Self-Authenticating Window based security features

3. SHADOW IMAGE TYPE SECURITY FEATURES

The functionality of the shadow image in GuardianTMsubstrate is the equivalent of the watermark on paper substrates. It is an excellent optical variable device that is invisible in reflected light and visible in transmitted light. Good quality shadow images are achieved by a careful selection and control of colour and opacity of the opacifying layers while maintaining a homogenous printing surface characteristics of the substrate that are required for other security printing processes.

4. CLEAR WINDOW TYPE SECURITY FEATURES

The clear window used in GuardianTMsubstrate is one of the pillars of polymer banknote technology, along with durability and cleanliness. The clear window is a simple and effective deterrent to photocopying and/or scanning. It is the most publicly recognisable feature on Australian banknotes, and the fact that it is difficult to reproduce renders it as a very important security feature.

However, the clear window provides an excellent platform for a large number of security devices that require the use of its optical properties. So far the following features have been produced that utilise this important property: Complex Window, Transitory Image, DOVD and DOE.

4.1 Complex Window

The complex window is a combination of the clear window and shadow image type security features. It is a feature that ranges from total transparency to a high level of opaqueness. The image changes in transmission to the image in reflection in a similar manner to the shadow image, with the added complexity of the highly transparent window. The optical property of transmission / reflection of the complex window can create devices with good security rating and at the same time can be easily recognisable by the general public. This device uses the transparency of the substrate to make a simple, secure and aesthetically pleasing feature.