"ROLICURE™ PEARL": An Optically Variable Device for Security Applications

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Abstract

Recently, we developed a novel optically variable security feature Rolicure™ Pearl. We report about its successful transfer from laboratory scale into manufacturing. While the origination work of Rolicure™ Pearl is based on ROLIC's proprietary photopolymer- and their processing technologies, its reproduction is performed on adequate equipment. Ideally, this new optically variable device (OVD) is manufactured as a foil product for use in hot-stamping, lamination or as self-adhesive labels.

ROLICURE™ PEARL devices exhibit brilliant, easily recognizable, high-resolution images, which switch from positive to negative when tilted or rotated. Even under demanding illumination conditions and within wide-ranging viewing angles ROLICURE™ PEARL images can be unambiguously revealed and identified with the naked eye. Although individual images can be of complex structure, the optical effect is straightforward and, hence, the verification process is easy to communicate. Being an overt device by itself, ROLICURE™ PEARL can easily be combined with covert features or tampering protection. Its uniqueness, its high level of protection and its cost effectiveness make it most suitable for application on fiduciary- and ID-documents as well as in high-end brand- and product protection.

Background

Today all conceivable products (pharmaceuticals, cigarettes, clothes, sports articles, luxury goods, spare parts, CD, DVD ...) and documents (banknotes, driver licenses, passports, credit cards...) are targets for forgery and counterfeiting. The consequences are often severe for both, the customer and the party selling these products or issuing those documents, respectively. As a consequence, there is a constant threat for loss of reputation, trust and money. For the cheated customer, the situation might even become dangerous or life threatening in the case that crucial machine parts or pharmaceutical products are involved.

For many years the industry has thus taken measures to fight forgery and counterfeiting. For the costumer, these efforts and means are obvious in the form of optical security features on all kind of products and documents.1 Within the great variety of today's security features, holograms and related diffractive OVDs are widely used and have generated a certain industry standard which has led to broad market acceptance over time. Today the hologram technology is a mature one and a long history of research, development and manufacturing know-how has been built up.

Most holograms spark in all rainbow colors and change their appearance rapidly upon tilting or rotating the device. Because of their sophisticated optical behavior holograms cannot be copied even with today's best color printers.

Since the hologram technology is already known for about 30 years and the respective production know-how is widespread, classic holograms are increasingly threatened by counterfeiters. For that reason, the hologram industry reacted by making its products more and more complex. This development has led to very sophisticated and partly complex combinational holograms, which are seen today representing a great challenge for counterfeiters. In parallel, this strategy represents a dilemma because such hologram complexity is more and more confusing for the customer to judge the authenticity of the device.

Hence, there is a great need for novel technologies that allow creating new security devices, which ideally make use of the public awareness and education with respect to OVDs, however providing an easier and reliable way of verification by the public. Following, we like to present such a novel technology, named Rolicure™ Pearl. Basic properties of the Rolicure™ Pearl feature and its transfer to pilot production will be described.

The ROLICURE™ PEARL Security Devices

ROLICURE™ PEARL security devices are based on Rolic's proprietary photopolymer and processing technology. With these materials and techniques it is possible to generate optical surfaces, which retain attractive scattering behavior. The optical properties are summarized as follows:

ROLICURE™ PEARL devices hold images, logos, text or graphical compositions with a very high resolution (> 1000 dpi). The name ROLICURE™ PEARL originates from its tender pearl-like brilliant appearance. Since no periodic grating structures are present in the device, no rainbow colors are observed and thus ROLICURE™ PEARL devices are easily distinguishable from classical (colorful) holograms. The device images change from positive to negative (contrast inversion) when they are tilted or rotated. In other words, ROLICURE™ PEARL represents a novel overt security feature of the OVD type.

The positive/negative image flip on tilting or on view angle change is illustrated in Figure 1.

ROLICURE™ PEARL devices reveal excellent contrast even at moderate illumination conditions and without use of a point light source. At good illumination the brightness of certain image areas exceeds even the brightness of white paper. This property is illustrated in Figure 2 and Figure 3 for two different illumination conditions resulting in a positive and a negative device image.

Even under demanding illumination conditions the image of the device can be identified.

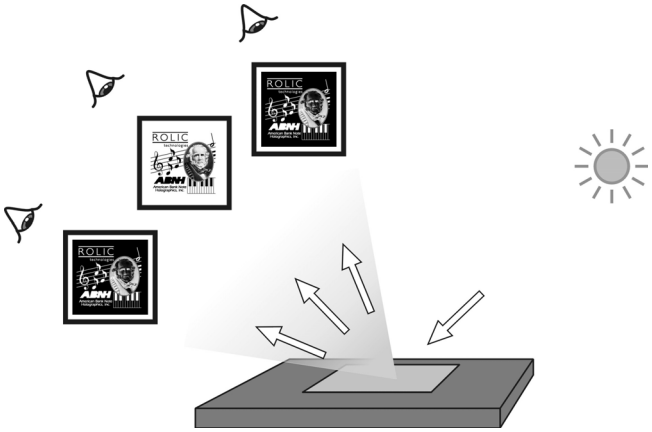

Figure 1. Illustration of the positive / negative image flip on viewing angle change.

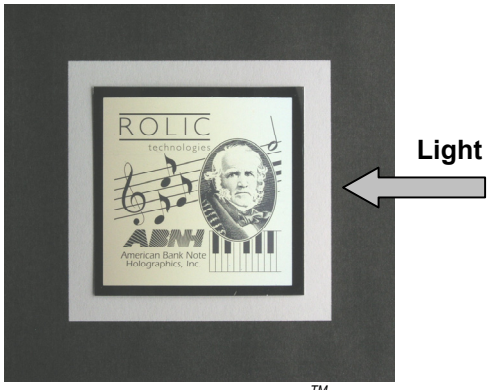

Figure 2. Photography of a ROLICURE™ PEARL device illuminated from the right. The device image appears positive. The image size without border is 28x28mm².

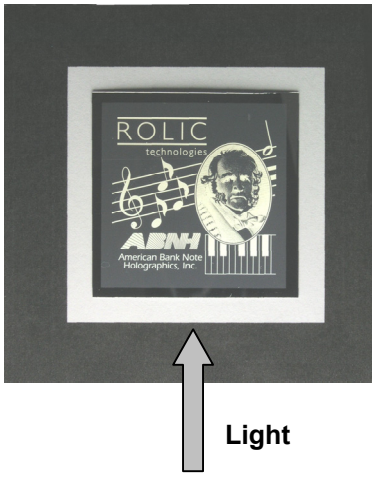

Figure 3. Photography of a ROLICURE™ PEARL device illuminated from the right. The device image appears positive.

Another attractive property of the ROLICURE™ PEARL device is the large viewing angle under which the image can be recognized. This is in contrast to many of today's OVDs, which are very sensitive to the illumination and readout angle.

The Production of ROLICURE™ PEARL

Production of ROLICURE™ PEARL devices in large volume can be done with adequate processing and equipment. Since its large-scale production is based on existing technologies the ROLICURE™ PEARL security devices can be offered at well competitive prices. For security reasons the required origination processes are done at Rolic Technologies' premises in Switzerland only and will not be made accessible to third parties.

Recently, the technology of ROLICURE™ PEARL has successfully been transferred from our labs to pilot production. As an example, a roll of a ROLICURE™ PEARL imaged film, cut to the width of 1.3 in, is shown in Figure 4. Such imaged film can be converted into consumer security products such as conventional transfer foils, self-adhesive labels, or lamination foils. Also achievable are special application forms, such as shrink sleeves, seal caps, blister foils and alike.

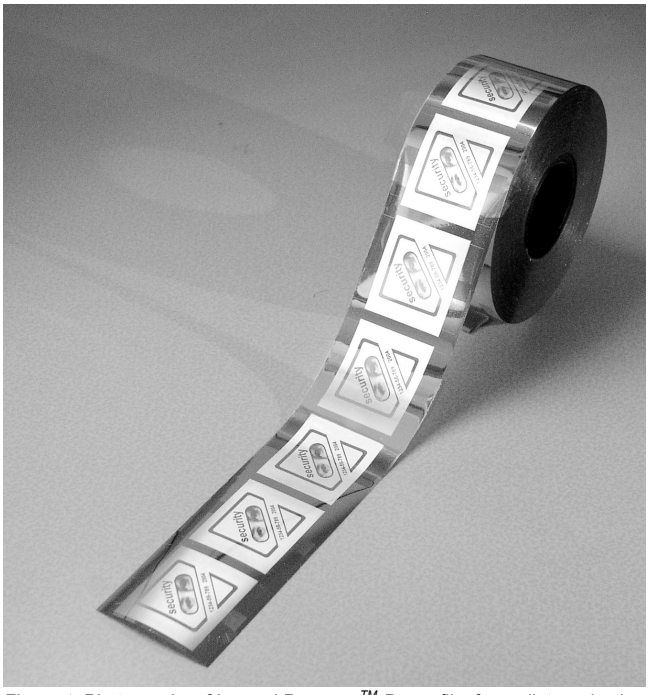

Figure 4. Photography of imaged ROLICURE™ PEARL film from pilot production.

An example of a ROLICURE™ PEARL patch applied by a hot transfer process onto a carton box is shown in Figure 5. As mentioned before, this sample nicely resembles the great brilliance of the bright area of the patch in comparison with the white unprinted areas of this box.

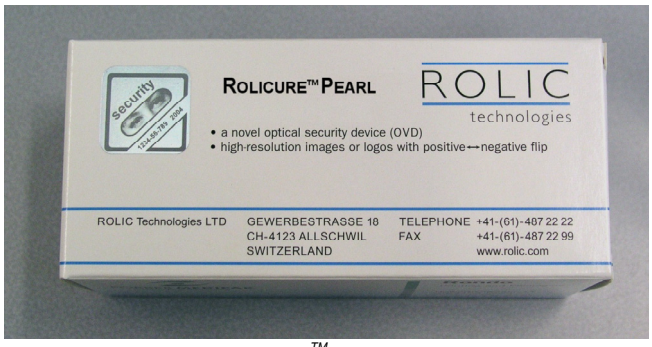

Figure 5. Photography of a ROLICURE™ PEARL patch applied by hot transfer onto a carton box as is typically used for pharmaceutical packaging.

The Protection of Products and Documents

The excellent contrast and brightness, the wide viewing-angle combined with the "straight forward" image information content make ROLICURE™ PEARL an attractive security feature specifically for the protection of goods which request easy public verification, such as pharmaceutical products. An important aspect is that the optical effect of the device can easily be communicated by and to non-professionals.

For a great number of applications in product and document protections semitransparent optical security features are required to allow recognition or reading of information underneath the security feature. ROLICURE™ PEARL allows the generation of semitransparent devices by additional processing steps. This can e.g. be done by adding a high refractive index film or by patterning the reflective metal layer.[3] With such a patterning any degree of transparency can be adjusted. An example of such a device is shown in Figure 6, exhibiting a high degree of transparency.

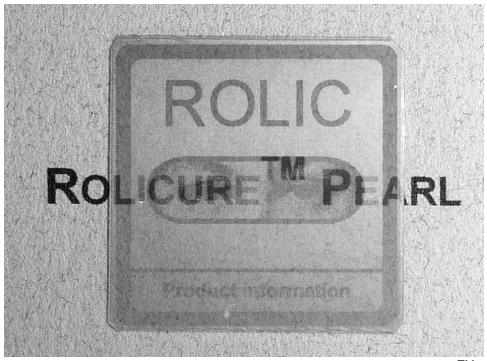

Figure 6. Photography of a semi-transparent ROLICURE™ PEARL patch, suitable for product and document protection. The device size is 20 x 20 mm².

The security protection level of our ROLICURE™ PEARL security feature can be further enhanced by combination with various overt or covert technologies. Because of the high image resolution of ROLICURE™ PEARL feature a straightforward method is to incorporate microtext or microimages into the image. Such additional microtext or microimage is not visible by the naked eye but can be recognized by use of a microscope or magnifier.

In specific, the ROLICURE™ PEARL feature can also be combined with a unique covert security feature, ROLICURE™ MAGIC, which has been presented recently.[4,5,6]

ROLICURE™ PEARL security devices can also be equipped with tamper evidence such that any attempt to manipulate the security device is finally apparent for the end user or an attempt to release the device results in its destruction.

Conclusion

In conclusion we have shown, that Rolicure™ Pearl is an attractive novel security feature that can easily be recognized and memorized by untrained people and can be implemented on a large variety of products and documents.

Many different extentions or combinations with other technologies make Rolicure™ PEARL a very versatile security feature. Its novelty in general and the strict control of its origination processes in specific make Rolicure™ Pearl an ideal security element for many protective means.

The successful pilot production of Rolicure™ Pearl has been demonstrated and Rolic Technologies is ready to quote for volume orders.

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Author Biography

Martin Stalder received his PhD 1987 from the University of Berne, Switzerland in the field of laser physics. From 1988 to 1991 he worked at the Center for Research and Education on Lasers, Orlando FL, USA, as a postdoc on tunable solid state lasers. In 1991 Martin Stalder started a liquid crystal research activity at the Paul Scherrer Institute in Zürich, Switzerland. 1997 he joined Rolic Technologies Ltd, Switzerland, where he is currently developing novel security devices based on Rolic's photopolymer and their process technology.