NANOTECH

INSIGHT

Securing Polymer Notes with Nano-Optic Features

Background

Polymer banknotes are produced from a synthetic polymer such as biaxially oriented polypropylene (BOPP). These notes can incorporate multiple security features like metameric inks, nano-optic and micro-lens features, transparent windows, diffraction grating, raised printing and more. Polymer banknotes can also include many of the same security features as paper banknotes, such as intaglio, metal strips, and microprinting. There is a growing trend favoring polymer banknotes over the past few years as they have been proven to last considerably longer than paper currency, reduce impact of the environment and decrease cost of production and replacement. As of February 2021, there are 1,026 banknote denominations globally. Of those denominations, 147 use polymer substrates, representing 14.3% of the overall substrate market, up from 5% in 2017, while the remainder use a cotton based or hybrid substrate.

Advantages

In the banknote industry in-depth, extensive research conducted by governments and central banks around the world all come to the same, evidence based and data-driven conclusion: polymer banknotes are greener than paper alternatives. They are also more durable and last longer, take more wear and tear and cost taxpayers less to make. Per a study from the Bank of Canada, durability of the two types of banknotes show significant differences:

3Y The cotton-paper substrate banknote has been considered to have a lifetime of 3 years.

7.5Y The polymer-substrate bank note has been considered to have a lifetime of 7.5 years. As demonstrated by the Reserve Bank of Australia, the cost of currency management is substantially reduced.

The polymer substrate shows benefits over cotton for all the main phases of the life cycle as well:

1

MANUFACTURING

Polymer notes and their encompassed security features have to be produced 2.5 fewer times than the cotton/ paper substrates

2

DISTRIBUTION

Polymer banknotes can incorporate ultra-thin security stripes, windows & features and have to be distributed 2.5 fewer times as its weight is lighter

3

END-OF-LIFE

Contained carbon in paper notes is released as greenhouse gases in landfills while polymer notes and can be recycled

Life Cycle

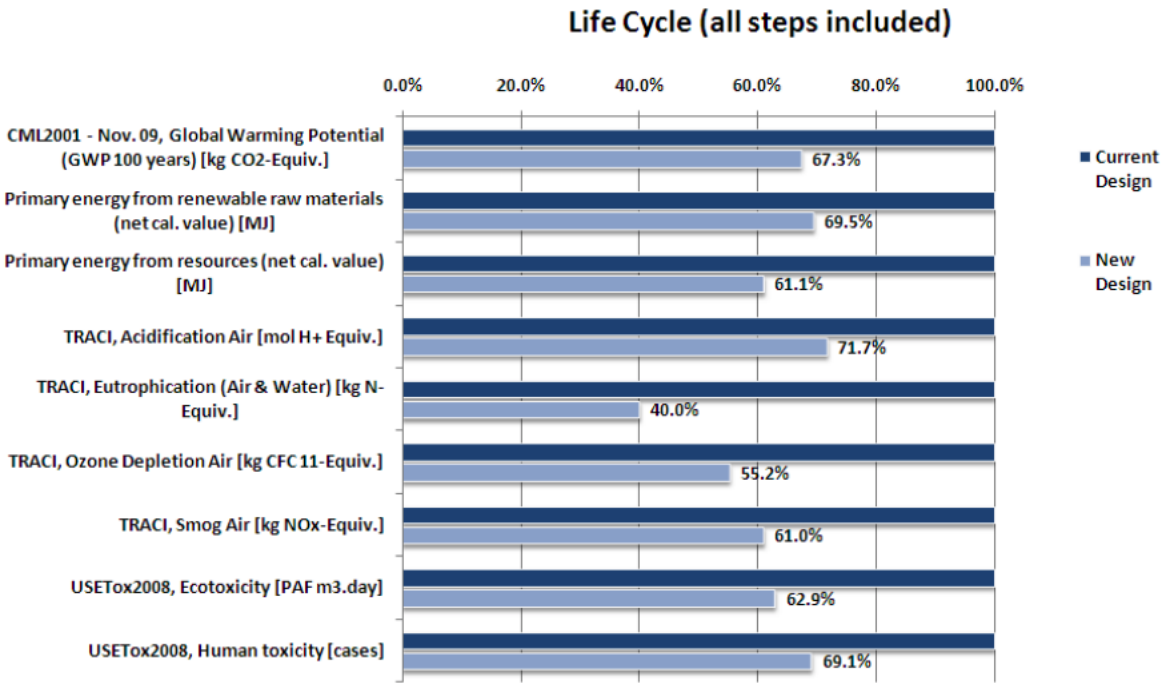


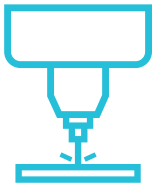
Fig 1: Bank of Canada study on Estimated environmental impact from the manufacturing and distribution of paper (current) vs polymer (new) banknotes

Nanotech Solutions

Nanotech's KolourOptik stripes are surface-applied products and could be used with any substrate, including polymer. KolourOptik® is a patented technology exclusive to the Govt. and banknote industry that combines sub-wavelength nanostructures and microstructures to create modern overt security features with unique and customizable visual effects. KolourOptik's pure plasmonic colour pixels patterned on ultra-thin microstructures create the thinnest, full-colour security stripes and threads that are nearly impossible to replicate.

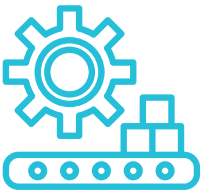
As a surface applied security feature, KolourOptik Stripes can be designed and validated to integrate seamlessly with the most popular banknote substrates. Nanotech's end-to-end production capabilities from design and origination, through to manufacturing, ensure we have the ability to adhere to the highest standard of quality at each stage. As a standardized surface applied stripe feature, partners can integrate KolourOptik security features without requiring changes to their substrate material or printing processes. Nanotech works directly with our integration partners to ensure that the stripe release and adhesives are tailored to meet the requirements for specific their application machinery, substrate specifications, and quality metrics.

DESIGN



ORIGINATION

RECOMBINATION



PRODUCTION

KolourOptik is redefining what is possible with overt, optical security features. With ultra-wide viewing angles, stable colours, movement, and depth, stripes created with KolourOptik equips Central Banks and banknote designers with an entirely new toolset for interactive and engaging visual storytelling. Based on industry-leading, proprietary innovations in nanotechnology, KolourOptik technology enables creation of one of the most secure and visually striking security features available. Nanotech's KolourOptik Platform was selected as a finalist for the International Association of Currency Affairs (IACA) 2020 Excellence in Currency Technical Awards in the category of Best New Currency Innovation.

KolourOptik + Polymer Notes = The Perfect Match

Based on Nanotech's KolourOptik nano-optic display technology, our products for Banknote and Government Documents include 100% customizable foils, threads, and stripes that combine movement, 3D stereo depth, and colour to deliver uncompromising security and currency authentication. These can be applied to polymer notes in the printworks stage and offer infinite prospects to engage the public by 'bringing to life' the value and security of a banknote.

ALWAYS ON

Arm your polymer note with a security feature that is easy to authenticate and light condition agnostic

3D STEREO DEPTH

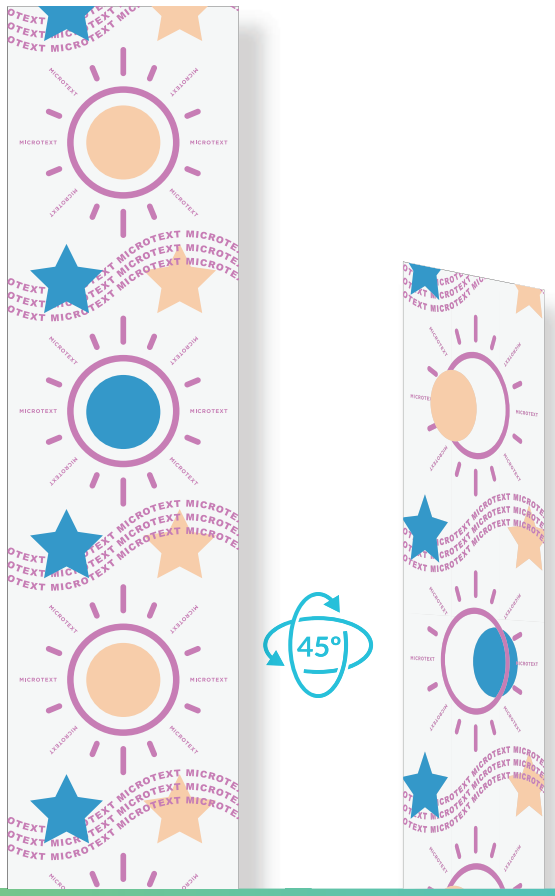
Three dimensional depth and floating effects that allow fastest polymer banknote authentication (<100 milliseconds)

MULTI-COLOUR PALETTE

Projects highly secure visual effects with specific colours on the banknote, no holographic rainbowing, no shiny metallized appearance

SUPPORTS FORENSIC FEATURES

Traceable only by central banks or law enforcement



HYGIENIC

A smoother surface means less bacteria, viruses, and dirt. Ultra-thin nano-scale form factor is 10-20x thinner than even lens-based optics, application on smooth polymer notes maintains the cleanliness of banknotes in circulation

ENVIRONMENTAL IMPACT

Dual 100kV e-beam lithography originations support the polymer banknote lifecycle and reduce environmental impact. Moreover, no inks, dyes, toxins, or chemicals are used to produce nano-optic features. The feature is created using hybrid nano and microstructures.

DURABILITY

To support the long life of polymer notes, the inherent strength and integrity of nano-scale structures guarantee a highly durable feature with thickness under five microns.

INTRODUCING NEW COUNTERFEIT BARRIERS

Secure, dual 100kV e-beam lithography originations backed by nano-optic technology protected by 75+ patents, non-commercial technology that is not available to the public

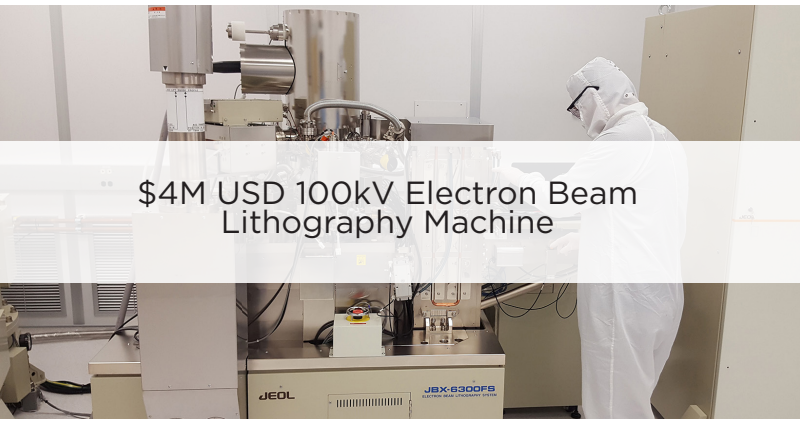


Fig 2: Manufacturing nano-optic security features is a specialized, expensive process with technology not available to counterfeiters

Conclusion

KolourOptik's advanced security features support polymer banknotes and significantly deter counterfeits. Firstly, it is intuitive to authenticate and provides the public with 'easy to verify' secure elements that are an integral part of banknote identity. Designs are not two-dimensional shapes with holographic colour that are easy for counterfeits to emulate – instead, they have a 'persona' with depth, fluid movement, and focused colours that depicts a story in a glance. Nano-optic features provide banknote designers with an entirely new compilation of unique visual effects to create polymer denominations with an identity meant for maximum public recognition. Visual elements have the capability to move simultaneously at different speeds and directions.

Secondly, it is extremely secure - it is nearly impossible to reproduce or reverse engineer these products due to Nanotech's proprietary software algorithms and patented nanostructures, microstructures, and nano-fabrication techniques. The technical foundation itself offers no straightforward starting point for potential counterfeiters – the hybrid nano and microstructures used to produce security features for polymer banknotes have no equivalents or counterparts in other industries. Designing a polymer series or even a commemorative note with KolourOptik security features is a process of collaboration and partnership. The innovative prospects are limitless, offering brand-new approaches to communicate cultural stories and build national pride through banknotes. Our team is happy to work with Central Banks, banknote producers, integrators, and issuers to best leverage the potential of nano-optic security features for polymer notes.