

**XIV PACIFIC RIM BANKNOTE PRINTERS
CONFERENCE**

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**POLYMER NOTES
- AN UPDATE**

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Introduction

Counterfeiting is an ever present threat for central banks. In the 1980's and 90's that threat loomed even larger as improvements in the quality of colour photocopiers, computer scanners and imaging software, accompanied by falls in the cost of such technology, brought high quality counterfeits within the reach of unskilled "casual" counterfeiters. At the same time, central banks in many countries came under pressure to reduce their costs and to implement reforms aimed at reducing payment system costs. These pressures show no signs of abating. It is no exaggeration to say that polymer notes can contribute much in helping to meet these various threats and demands, as Australia's recent experience confirms.

Overview

By its very nature, polymer substrate has much to offer. Security is enhanced by the ability to control the transparency of the substrate from clear to opaque; the application of coatings which can be used in a variety of ways to manipulate note feel; and the surface properties of the polymer which can enhance print features like optically variable inks. Durability is enhanced because of the non-porous, non-fibrous nature of polymer substrate and its toughness, with further protection for the inks provided by the overcoat. Longer note life quickly translates to reduced new note requirements and lower note issuing and processing costs. Functionality is enhanced by polymers' cleanliness, toughness and the retention of stiffness (polymer notes don't go limp) that result in significant productivity gains and cost savings, especially in machine processing by central banks and third parties.

Security

The ability to control the transparency of polymer substrates has resulted in new, yet conceptually simple and effective security features. The most obvious feature is the clear window(s) or half window(s) (the latter allows, for example, a feature embedded under print on one side of the note to be seen from the other side of the note). A clear window can be used with enhanced features such as blind embossing; or a feature can be embossed which switches from being visible to invisible, or switches from one image to another, as the note is tilted. Such features cannot be copied by reprographic techniques.

The Bank has also developed a number of "self-authenticating" features into polymer notes by converting the clear window into a device for verifying another feature in the note. For example:

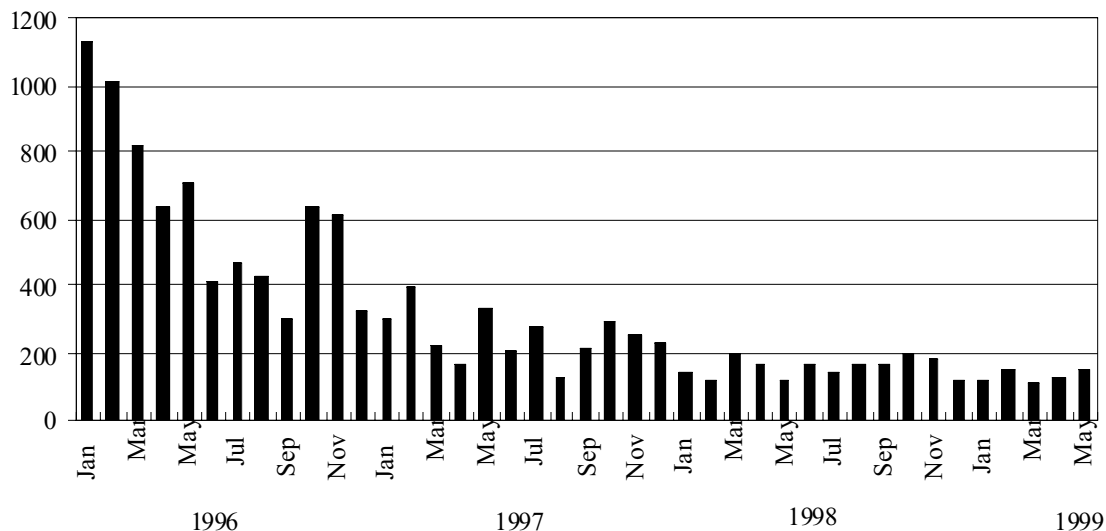
- the window can incorporate a filter for a pair of metameric inks printed elsewhere in the note's design;
- the window could contain a screen for identifying features such as the Joh. Enschedé's μ -SAM® feature printed elsewhere in the note's design.

Further examples of these features are under development.

These examples show another significant advantage of polymer; namely, the close integration of substrate features with traditional print or add-on features. Many features are unique to polymer. Furthermore, the security provided by traditional features is often enhanced by polymer. For example, polymers' smooth surface gives much better optical effects for print features like optically variable inks (OVI's) than is possible on paper. Moreover, the ability to place OVD's in clear windows means they are visible from either side of a note.

These few examples demonstrate the ease and simplicity of verifying a polymer note as genuine. That is not to say that it is impossible to counterfeit polymer notes. Nevertheless, polymer notes increase the degree of difficulty, time and cost of making counterfeits. Even with the most basic of polymer security features, Australia's counterfeiting rate has declined significantly as illustrated in the graph below.

NUMBER OF COUNTERFEITS PASSED



One of Australia's major achievements since the introduction of polymer notes has been the virtual cessation of "casual" counterfeiting. Notwithstanding the significant drop in counterfeiting the risks are ever present, and polymer note technology has many new security features ready to meet any future threat.

Australia uses Guardian® substrate, a specialised form of Biaxially Orientated Polypropylene (BOPP). Even though there are commercial forms of BOPP available (traditionalists need to remember that there are commercially available rag papers), the film produced by UCB when combined with the unique tried and proven coatings and subsequent security features, has many advantages as a security substrate:

- Guardian® will not run through a modern colour copier or laser printer, forcing counterfeiters to use alternative plastics;
- alternative plastics are generally not available in the thickness needed and so have to be laminated together;
- many plastics do not have the clarity needed or cannot be opacified without loss of clarity of the window;
- alternative plastics have distinctly different sound and feel to Guardian®.

Functionality

Polymer notes have now been in circulation in Australia for over seven years. They work well in all climatic conditions. For manual processing, there are minor handling differences between polymer and paper notes which may require some flexibility on cash handlers' part, but this is not a concern. Australia's experience is that people adjusted very quickly to the change. When we ask professional cash handlers if they want to go back to paper notes they say, overwhelmingly, "No"!

Recent surveys of users and suppliers of machines that process notes have confirmed that polymer notes are better for machine processing than paper notes. The extent of improvement can also be significant. The types of machines involved in the survey included note counters, note acceptors/validators, and note dispensers (eg ATMs).

Relative to paper notes polymer notes perform better because:

- polymer notes are, on average, of better quality;
- polymer notes deposit less inks and dirt on transport belts and sensors;
- polymer notes create less dust;
- polymer notes feed and count better because polymer notes are stiffer.

The improvements are reflected in a variety of ways, less jams, fewer service call outs, and reduced maintenance staff. In short, reduced third-party machine processing costs.

Durability

Australia's move to polymer substrate was initially based purely on the need for improved banknote security. Happily, polymer has also proven to be significantly more durable and cost effective than paper notes. Australia has experienced a quadrupling of the average life of low denomination notes with the move to polymer, more than offsetting the higher costs of production. Higher denomination polymer notes have not been in circulation long enough to be precise about their longevity, but indications are that we will see a similarly impressive performance.

The greater security and durability of polymer notes means that they do not need to be checked as often for authenticity and wear and tear. Whereas the Reserve Bank had been processing notes in circulation on average 3.5 times a year, in future the Bank aims to achieve its objectives by processing notes in circulation on average twice each year, resulting in significant cost savings. To achieve this the Bank has changed distribution arrangements as outlined in a separate paper to the conference.

For some countries, cost considerations are more important than security. Even if this is not the case, the improved cost effectiveness of polymer notes from added durability can be used to offset the higher costs of including advanced security features.

The increased durability of polymer notes is a consequence of various factors, including:

- the non-porous and non-fibrous nature of the substrate, and the overcoating of finished notes with a clear varnish, mean that the notes do not absorb moisture (oils, sweat, beverages, etc) like paper notes. These same properties also mean that the notes do not stain or accumulate dirt as easily as paper notes do;
- the non-fibrous nature of the polymer substrate also means that the substrate does not physically breakdown with repeated folding, as occurs with paper notes which, in part, causes paper notes to go limp;
- the toughness of the polymer substrate makes it much more difficult to initiate a tear in a polymer note compared to a paper note (although it is true that once a tear is initiated in a polymer note it propagates more easily than in a paper note, the initial toughness appears to be the overriding characteristic).

The results of a survey of public acceptance and performance conducted at the end of the trial of polymer note technology in 1988/89 indicated that:

- 88% of those surveyed perceived a major advantage of polymer notes was their resistance to damage;
- 87% appreciated the notes' cleanliness.

Our experience shows that the cleanliness aspects of polymer notes are much appreciated by the public and cash handlers.

The different characteristics of polymer notes outlined above mean that polymer notes wear differently to paper notes. Consequently, the criteria used in manual or machine processing for deciding if a polymer note is no longer fit for reissue are different to paper notes. When paper notes were used in Australia the primary sorting criteria for paper notes were either soiling (which correlates well with limpness) or mechanical faults (tears, holes, etc). For polymer notes the primary sorting criteria are mechanical faults and ink wear. Polymer notes do not soil like paper notes.

During their long life, polymer notes experience folding and crumpling many times. Eventually, the cumulative effect of abrasion along fold and crumple lines in a very robust substrate causes ink to wear. Initially, this is very minor and difficult to see as it usually involves ink being worn away in very thin lines. Eventually, after very extended use in circulation, these areas of ink wear widen and deepen and become more noticeable. Because major fold lines tend to be concentrated around the centre of the note, ink wear also tends to be concentrated in this area as well. This wear has thus become an additional important fitness sorting criterion for both manual and machine processing.

Again it is important to remember, however, that the polymer notes which have been in circulation for the longest time in Australia are lasting *at least* four times longer than their paper equivalents were before ink wear suggests that they could be taken out of circulation.

Environmental

As environmental issues become more important, it is significant that polymer notes again offer advantages over paper notes. In particular:

- polymer substrate is less polluting and more energy efficient in production; and
- polymer notes are recyclable at the end of their useful life.

In Australia, all unfit polymer notes are being recycled. Previously, we burnt or added to land fill our unfit paper notes.

Other countries

Polymers' benefits are being recognised by an increasing number of countries. Apart from Australia, those to have issued polymer notes for long term use in circulation include Thailand, Sri Lanka, Brunei, Papua New Guinea, Western Samoa and more recently Taiwan and New Zealand. Another two countries will release polymer notes later this year. Many countries around the world are conducting printing trials on polymer substrate. A number of other countries have, or are interested in releasing, commemorative notes on polymer substrate.

Conclusion

Polymer notes continue to offer:

- proven security benefits;
- exciting new security features that further enhance the role of the substrate, and, importantly, integrate substrate with print and/or add-on features;
- improved cost effectiveness via lower note issuing and processing costs;
- a quantum improvement in cleanliness and durability;
- a quantum improvement in machine processing;
- a more environmentally friendly product.

All in all, Australia's extended experience with polymer notes continues to confirm the superiority of polymer notes over the paper notes they replaced.