

# CARD

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# The Market for "Green" Cards is Blooming...

But is there a Silver-Bullet Substrate that Hits the Sustainability Mark?



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Klöckner  
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**S**ustainability has seen significant growth

through the efforts of many product companies, retailers and material suppliers who are all, at lightening speed, instituting corporate sustainability initiatives. The underlying message is that what's good for the environment is good for business, especially as consumers become more environmentally conscious with their purchasing choices. Thus appealing to consumers through "green" products is good for business. One can easily note the rapid increase in "green" advertisements these days as proof.

## Knowledge shines a light on the sustainability void

As sustainability initiatives continue to evolve, however, many companies are left in a lurch. They are unsure what qualifies a product as sustainable, frequently holding misperceptions that do not comport with reality. With limited expertise, many don't even know where to go for information. It's here that suppliers must step into the void with the knowledge to assist customers in making the best material decisions.

Herein is an attempt to shed light on the methodology for evaluating a variety of plastic substrates for the card market within three categories of evaluation. This study not only includes a view toward sustainability, but also gives serious

CARD FUNCTIONALITY						
Characteristic	PVC	rPVC	PETG	PLA	HIPS	PS (modified)
Specific Gravity (estimated)	1.38	1.38	1.35	1.29	1.07	1.07
Physical Card Parameters	Pass	Pass	Pass	Pass	Pass	Pass
Card Dimensional Stability	Pass	Pass	Pass	Fail	Pass	Pass
Card Flexure	Pass	Pass	Fail	Fail	Pass	Unknown
Static Stress*	Benchmark	Ok	Lower	Lower	Ok	Ok
Impact Resistance	Pass	Pass	Pass	Fail	Fail	Unknown
Embossed Height Retention	Pass	Pass	Fail	Fail	Fail	Unknown
Material Costs (per million cards)	Neutral	Neutral/ Higher	Higher	Higher	Higher	Higher

\*Static stress test method is detailed NCITS 322. Results were compared to historical norms for a PVC financial transaction card application.  
NOTE: All products were printed card bodies manufactured with kp films and tested at Eclipse Labs to ISO 7810, Identification cards - Physical characteristics.

thought to the processability at the card manufacturer and card functionality. (Sustainability covered in this article will pertain only to environmental factors and exclude social and economic aspects.) The virtues of using PVC, PETG, PLA and conventional and enhanced polystyrenes are considered. Excluded are polypropylene and high-density polyethylene due to their general softness, polycarbonate due to cost, and polymers using biodegradable additives that do not meet global standards for compostable products.

## Does a silver bullet exist?

Unfortunately, there is no one answer, no one substrate, that achieves a proper balance between the three categories already described: Sustainability, Processability and Functionality. In fact, what follows is not the only approach for evaluating card sustainability. Rather, this is a broad overview for evaluating a variety of plastic substrates for the card market. This broad overview is meant to create a framework for discussion with the end customer whose name and logo will appear on the card. The object of which is to make informed choices about which substrate is the

best recommendation for the job at hand.

## The triad of Austainability, Processability and Functionality

Many factors go into each of the three categories:

- Under the category "Sustainability," there are a number of environmental indicators including energy consumption, greenhouse gas emissions, recycle content/recyclability and other factors.
- Under the category "Processability," such questions have to be asked as, "How do the various substrates print? Laminate? Die-cut? Etc."
- Is card performance under the category "Functionality" compliant with ISO 7810 using the various substrates noted above?

Keep in mind that the discussion is ever evolving, so there cannot be any definitive conclusion. What we have here is simply a current snapshot of gathered information to date. The following matrices are dynamic and constantly changing. Current test results will most likely lead to future formulation changes designed as an overall upgrade of card products balancing between environmental concerns, processability at the card manufacturing facility, and card performance.



### Separating fact from fiction

But, for the moment, let's try to separate fact from fiction. Looking at the facts is the only real way to know how the various card products compare on the sustainability criteria. A few typical questions are:

- Is pre-consumer recycled PVC card content more sustainable than a traditional PVC card?
- Is a PLA card more sustainable than PETG because it is made from renewable resources?
- Can PETG be considered environmentally better than HIPS because it is perceived to be recycled?

These matrices will give a clear reference and comparison of the various substrates based on information taken from respected sources.

### Sustainability

Among the more environmentally aware brand owners, two of the most recognized sustainability characteristics are energy use and greenhouse gas emissions. Nonetheless, there are certainly more than these two obvious sustainability characteristics on which to judge substrates and the "Card Sustainability Characteristics" matrix addresses this. The chart under consideration here is based upon the production of one million cards in a 30-mil thick CR-80 format and takes into consideration the specific gravity differences between substrates. Thus, we have created a level playing field specifically for the card market.

Information on sustainability has been extrapolated from credible studies such as, "Eco-profiles of the European Plastics Industry," by Boustead Consulting, on behalf of PlasticsEurope. Also referenced are the eco-profiles of NatureWorks® PLA by Vink. These eco-profiles are a way of recording "cradle-to-gate." That is, cradle-to-resin pellet attributes for different plastics.

Characteristics included are: energy use, greenhouse gas emissions, equivalent oil consumption, water consumption, recyclable information, whether the product can be designated compostable or biodegradable, and

CARD SUSTAINABILITY CHARACTERISTICS						
Characteristic (Energy, GHG, oil, and water parameters based upon resin used to produce 1 million cards)	PVC	rPVC*	PETG	PLA	HIPS	PS (modified)
Energy (in GJ)	280	< 280	392	332	321	352
Greenhouse Gas Emissions (CO <sub>2</sub> e) (in '000 kg)	9.4	< 9.4	16.0	8.9	12.5	13.9
Equivalent Oil Consumption (in barrels)	46	< 46	64	54	52	58
Water Consumption (in '000 gallons)	13.1	< 13.1	6.3	61	9.7	9.9
Technically Recyclable	Yes	Yes	Yes	Yes	Yes	Yes
Municipally Recycled	No	No	No	No	No	No
Biodegradable/Compostable (per ASTM specifications D6400 and/or D6868) *Requires industrial compost facility; limited access **Could be compromised by formulation additives	No	No	No	Yes*, **	No	No
Renewable *PVC is derived from 57% abundant natural salt	No*	No*	No	Yes	No	No

\*PVC values could be significantly less than estimated here.

Sources and Assumptions:

1. Boustead I. Eco-profiles of the European Plastics Industry, PlasticsEurope, Avenue E van Nieuwenhuysse 4, B-1160, Brussels, Belgium.

http://www.lca.plastics-europe.org

2. Vink E.T.H. et al. The eco-profiles for current and near-future NatureWorks® polylactide (PLA) production.

Industrial Biotechnology, Volume 3, Number 1, 2007, Page 58-81, PLAS

3. Assumption for PETG is same for APET and adjusted for specific gravity difference



finally, whether the material is made from renewable resources. (Although keep in mind, this is not intended to be an all-inclusive list of characteristics).

Looking at this matrix, you'll note first and foremost that there is no clear substrate winner that dominates in every category. However, numbers in bold have the best or near best data in each category.

Based on what we've learned so far from this matrix, again, there is no "silver bullet" substrate to answer the needs of all environmental contingencies. Thus, decisions have to be made—and not by the film or card manufacturers—but rather by card issuers as to what sustainability characteristics are most important to their company.

For example, let's spotlight PLA. As shown here at 8,900 kg CO<sub>2</sub>e, it fares well in the area of "greenhouse gas emissions" when taking into account its specific gravity. Also attractively from a "green" marketing standpoint, the PLA pellet is processed from renewable resources. This is an advantage over its petroleum-based counterparts. PLA also may qualify as compostable under specific film formulations and disposal conditions.

But to make the "silver bullet" point again: Though PLA emits the lowest amount of greenhouse gases, we'll

see that it does not fare as well under the second and third categories of Processability or Functionality, for example, where the PLA end product may be less durable than desired.

That's of course if "greenhouse gas emissions" is the card issuer's environmental focus. However, what if the card issuer deems energy consumption as the most important card sustainability characteristic? Then PVC and recycled rPVC at 280 GJ would be a contender. But PETG at 6,300 gallons might win out if water consumption were the most critical characteristic to a card issuer.

You'll note that all six substrates under study on the "Card Sustainability Characteristics" matrix are technically recyclable. But practically speaking, post-consumer card recycling is negligible. And biodegradable or compostable cards come with caveats. Very few industrial composting facilities exist today in the United States. At present, most card products are disposed of in a landfill, not composted.

In the next issue, June/July 2009, I will discuss Processability and Functionality. ●

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### Processability

Let's turn now to the second category of Processability and the matrix that goes with it. The information found in the "Card Processability" chart is based upon printed and finished CR-80 card products using films from Klöckner Pentaplast. While formulations can vary between suppliers, it is fair to say that the data collected shows what potential issues film producers, card manufacturers and card issuers may face when introducing new card substrates.

In this processability matrix, "Std" means "standard" and represents known or traditional processing conditions. Highlighted in bold red, "Adj." indicates which substrates may require one of several adjustments in the manufacturing processes with respect to printability, lamination, die punching and magnetic (mag) stripe application.

It is noteworthy that PETG and PLA are highlighted in bold red "Adj." in every one of these categories. With the addition of dye-sublimation, PETG earns its only "Std" designation, while further evaluation is required for PLA. A modified PS also joins the "Adj." rating in the die-punching category.

Adjustments are explained thus: For printability, PETG and PLA may require surface treatment, primer or use of special inks. The aim of a special type or brand of ink would be to improve both ink adhesion and

CARD PROCESSABILITY						
Characteristic	PVC	rPVC	PETG	PLA	HIPS	PS (modified)
<b>Printability</b> <small>*May require surface treatment, primer, or use of special inks</small>	Std.	Std.	<b>Adj.*</b>	<b>Adj.*</b>	Std.	Std.
<b>Lamination</b> <small>*Requires cycle adjustment</small>	Std.	Std.	<b>Adj.*</b>	<b>Adj.*</b>	Std.	Std.
<b>Punching</b> <small>*May require tolerance adjustment **May have feeding issues</small>	Std.	Std.	<b>Adj.*</b>	<b>Adj.*</b>	Std.	<b>Adj.**</b>
<b>Magnetic Stripe</b> (core or overlay) <small>*Requires tape with special sizing</small>	Std.	Std.	<b>Adj.*</b>	<b>Adj.*</b>	Std.	Std.
<b>Dye-Sublimation</b> <small>(applicable to laminated card product only)</small>	Std.	Std.	Std.	Unknown	N/A	N/A

peel strength between over-laminate and core, and also further minimize card brittleness. For lamination, PETG and PLA would require cycle adjustment. For die punching, PETG and PLA could require tolerance adjustment, and enhanced PS may have feeding issues.

As for adjustments in the application of a mag stripe to coated PLA over laminate, the magnetic tape may require different sizing. During tape application, activation of the adhesive when using a coated PLA overlay substrate has been known to occur. It has the potential to become another processing concern.

### Functionality

Focusing attention now on the third category of Functionality and the accompanying matrix, the initial indications are that some substrates may have some type of performance deficiency to the ISO 7810 specification. PVC is the only substrate to earn a "pass" on all the stated functionality characteristics. All but PLA passes "card dimensional stability." Both PETG and PLA fail "card flexure" and the historic norms of "static stress" results per test method NCITS 322. And all but PLA

and HIPS pass "impact resistance." Several other functionality factors remain "unknown" for specific substrates as of this moment.

Even though PETG, PLA and HIPS all fail in the area of "embossed height retention," it is one functionality characteristic that may be overcome with flat-line printing should the card market decide to go that way. Card manufacturers at the direction of card issuers may choose to use such existing alternatives—or develop new ones—to successfully integrate card products made from substrates other than PVC in order to overcome this kind of card deficiency.

Of course, "material costs" are perennially a weighty decision-making factor. To date, PVC is still the most inexpensive choice for card substrates. All other substrates under discussion incur a higher cost.

### What's good for business is good for the consumer, and vice versa

So we have come full circle around to the original question, "Is one type of card substrate more sustainable than another?" The simple answer is, "No." The sustainability matrix used here for various plastic substrates show no clear-cut winner. Recycled

*continued on page 24*

*Blooming, continued from page 23*

substrates undoubtedly will have sustainability benefits over their conventional virgin-resin card counterparts. Beyond that, each substrate has trade-offs. But no matter what, a sustainable card product is not viable if it cannot be processed successfully or is functionally deficient. Which is why the second and third matrices were developed and included in the study. Even if new sustainable formulations are developed, their substrate performance characteristics require specific and credible documentation to ISO 7810.

So the provisional conclusion is the same as the premise with which we began: There is no silver-bullet card substrate that excels above the rest when evaluated and compared under the tri-category matrices of

Sustainability, Processability and Functionality. The decision of which substrate to use is the individual card issuer's, mainly based upon his environmental focus. The card issuer must ask questions, to which this readership hopefully now can answer with greater knowledge, always ensuring that new substrates comply with or close to ISO 7810 and potential processing issues at the card manufacturing facility cannot be ignored.

Be assured that the customer will be weighing their card substrate decisions with greater and greater awareness of its sustainability characteristics. ●

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