High Barrier PLA Films For Flexible Packaging

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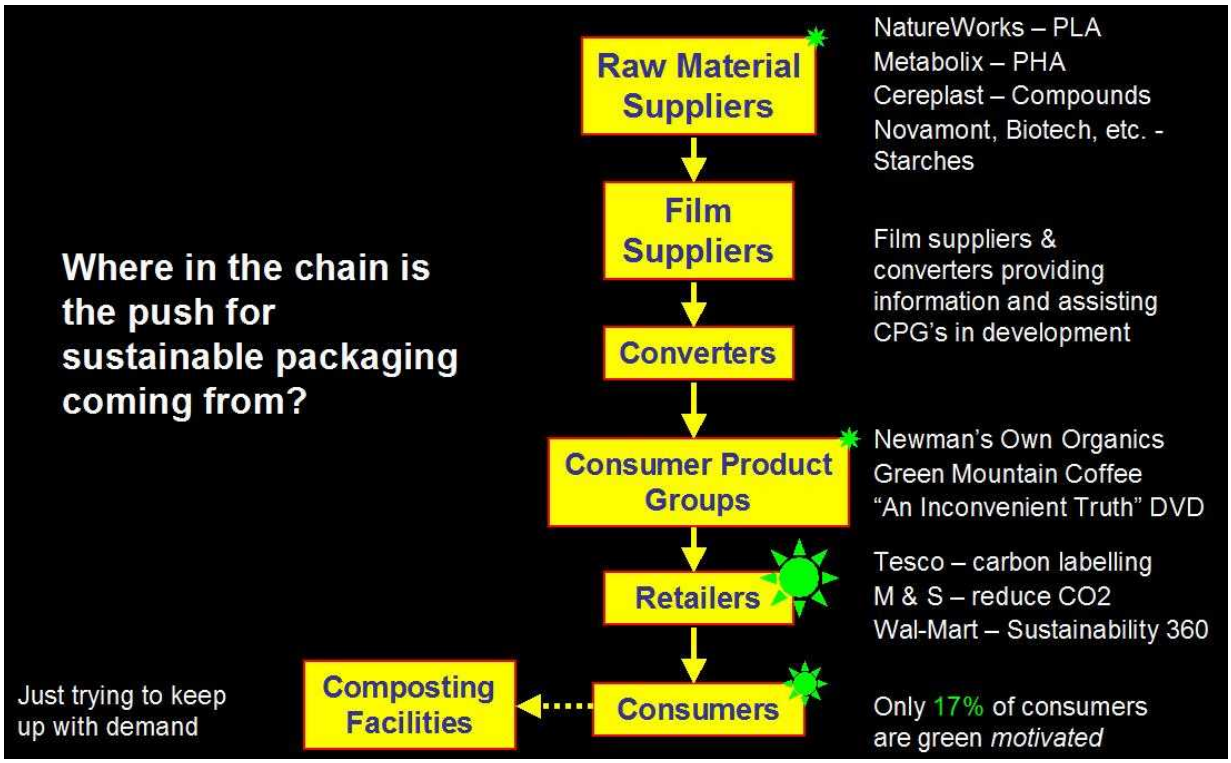
Industry Drivers

We know that sustainable packaging is a hot topic today, but in order to understand where this drive is coming from, we need to examine the entire supply chain. Figure 1 shows that although there are many influences on the push for sustainable packaging, the primary drivers of this movement are the retailers.

Figure 1: Sustainable Packaging Drivers

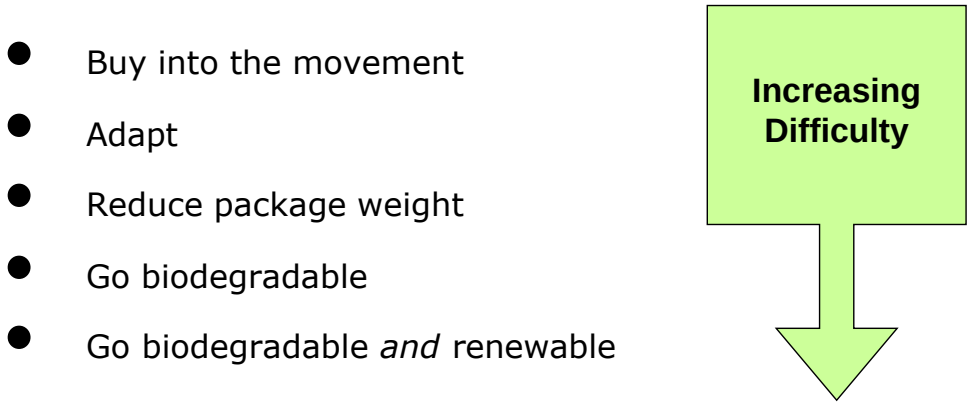


We also need to consider that western governments are also concerned with raw material supplies, and oil in particular. The majority of westernized countries are net importers of oil, which typically comes from geopolitically unstable regions of the world (Russia, Middle East, Nigeria, etc.). Therefore, governments are also playing a role in promoting sustainability and less dependence on oil and chemicals derived from oil.

Options for the Converter

What are the options for the flexible packaging converter? Figure 2 lists the options in order from easiest to most difficult in terms of implementing solutions.

Figure 2: Options for the Converter



Of course, the more difficult options also offer the largest potential rewards for converters, as these will be the most difficult to duplicate and will add the most value to Brand Owners in their effort to meet the sustainability demands of retailers.

Historically, there have always been options such as paper and cellophane which are made from renewable resources. The latest widely available product in this area is PLA (poly lactic acid) film.

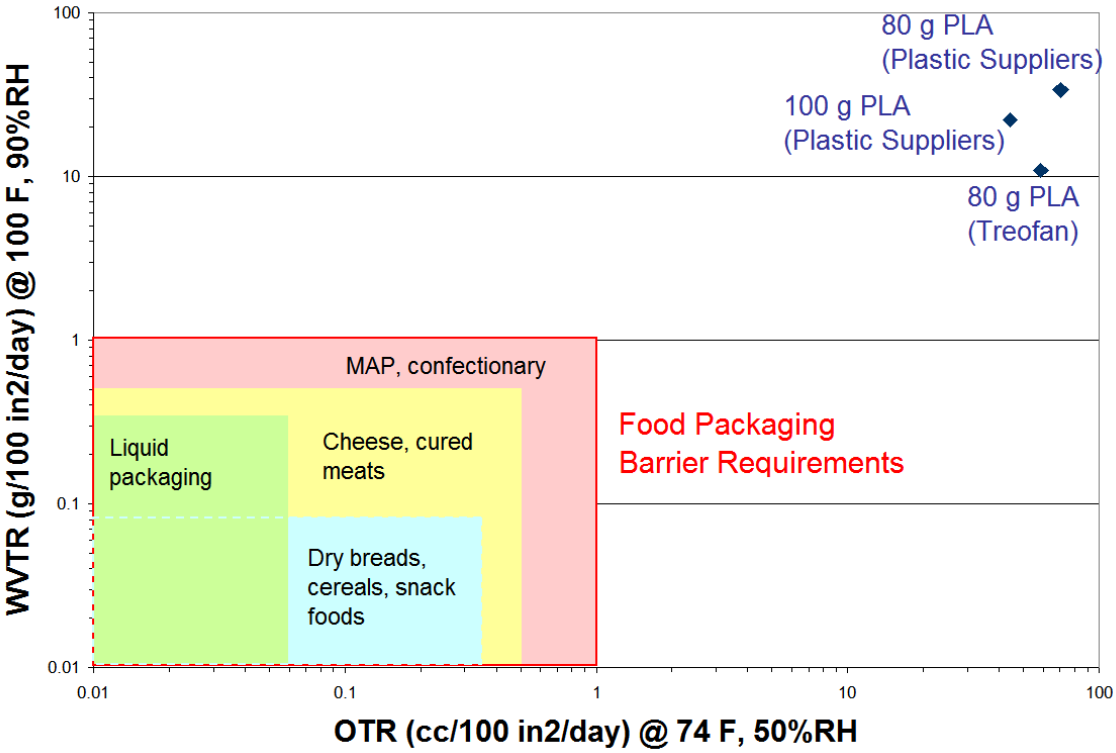
PLA Films

There are several benefits to using PLA films in a flexible packaging structure:
- it processes similar to PET film
- good availability - two film manufacturers in North America, several globally
- high clarity
- good deadfold
- it heat seals to itself – good bond strength
- it is made from a renewable resource – corn
- it is compostable:
    - meets ASTM D6400 standard in North America
    - meets EN 13432 standard in Europe
    - meets GreenPLA certification in Japan

However, there are also two hurdles to using PLA films in packaging applications:
- low heat resistance (film begins to soften and flow at around 60°C)
- poor barrier properties

Figure 3 on the following page shows where standard PLA film barrier properties stand relative to the needs of barrier-type food packaging applications.

Figure 3: Uncoated PLA Barrier Properties Compared to Barrier Food Packaging Applications



It is apparent that these films on their own will not meet the needs of barrier food packaging markets, and are in fact approximately two orders of magnitude away from meeting these barrier properties.

High Barrier PLA Films

There are now two options for converters to allow them to meet these high barrier requirements with inorganic, inert, non-petroleum products:

- SiOx-coated PLA
- High barrier metallized PLA

The effects of each of these coatings on the barrier properties of the respective PLA films they have been applied to can be seen in Figures 4-6 on the following pages. Note that for the metallized films, commercial PLA-to-PLA and PLA-to-paper lamination data is still being generated, so we only offer projections based on our experience to date with lab laminations. These closely follow the actual SiOx-coated PLA lamination test results.

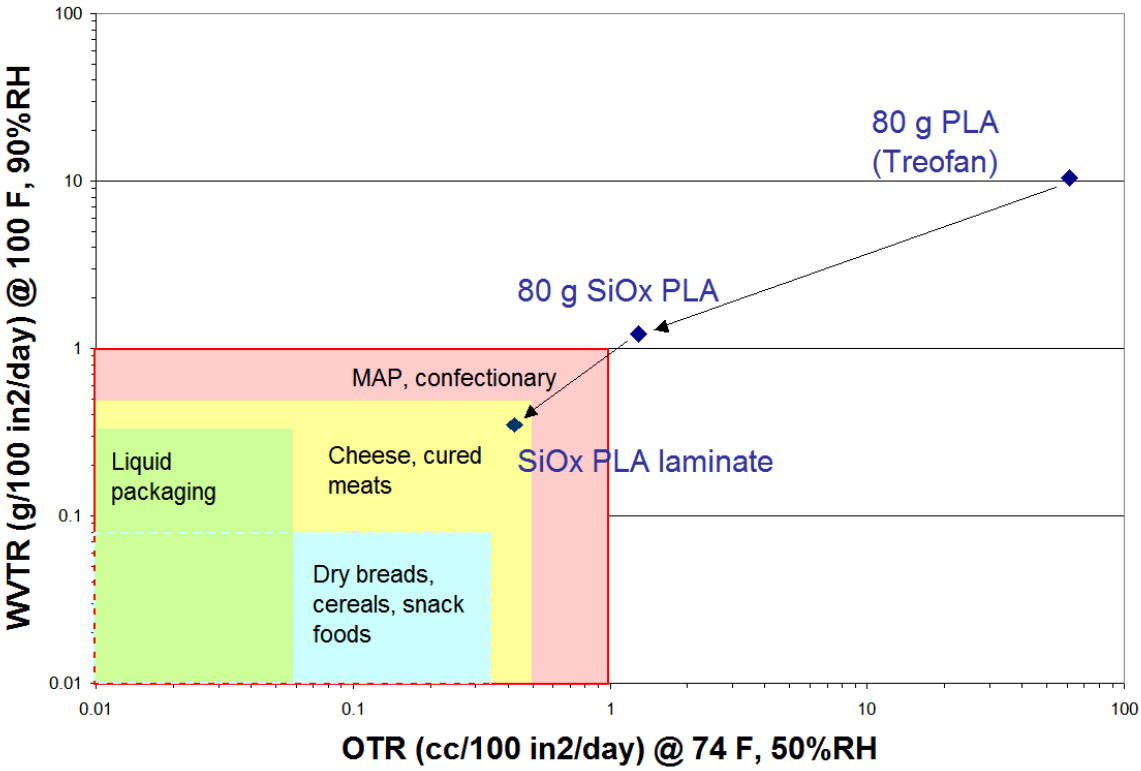


Figure 4: SiOx-coated Clear Barrier on 80 g PLA Film

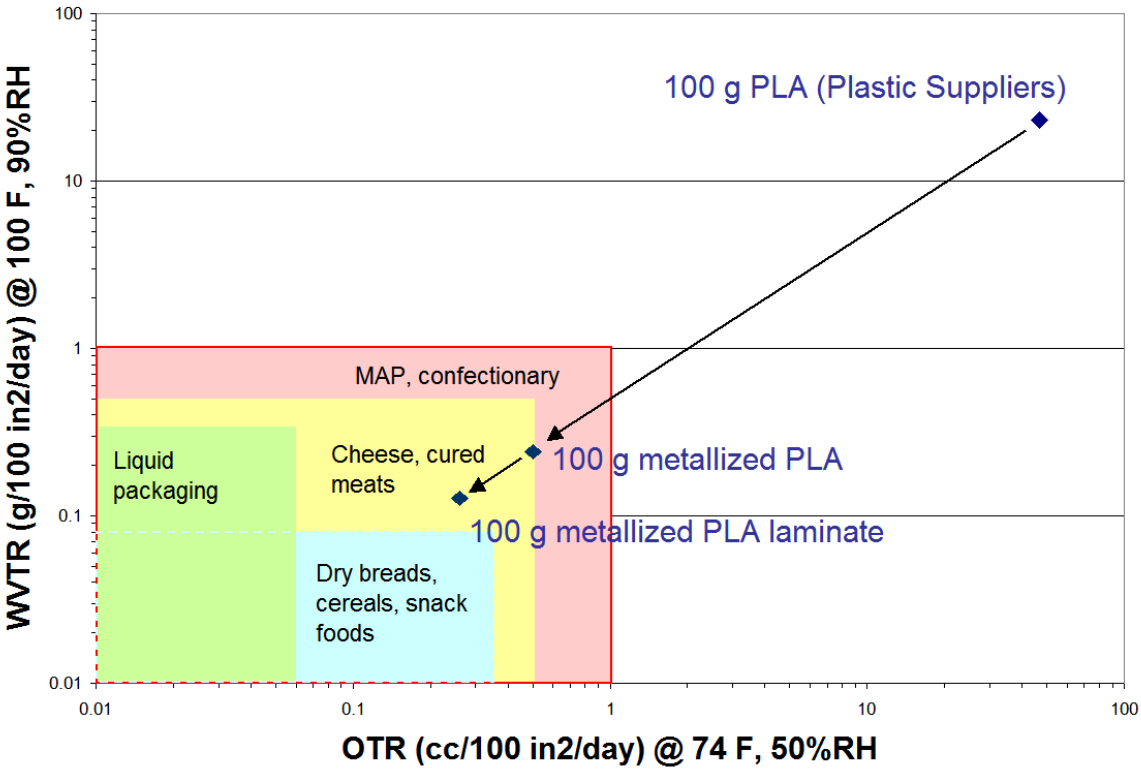
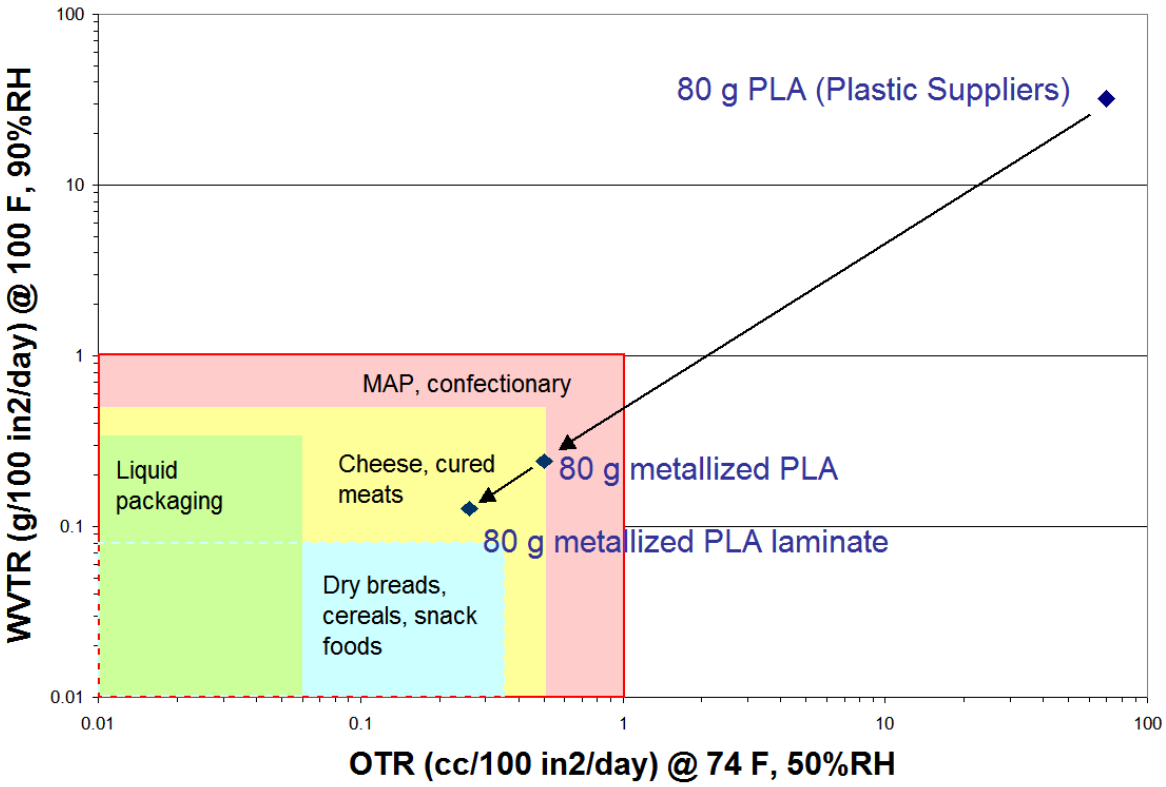


Figure 5: High Barrier Metallizing on 100 g PLA Film

Figure 6: High Barrier Metallizing on 80 g PLA Film



It can be seen that all of these products provide a significant level of improvement in barrier properties relative to the clear PLA films. In particular, the PLA film metallized under high barrier metallizing conditions, will allow converters to meet the barrier needs of more applications than ever with a biodegradable, renewable-resource based film. Furthermore, the improvements in barrier properties that have been achieved with metallizing appear to be independent of the thickness of the base film to which they are being applied.

Conclusions

As retailers such as Wal-Mart and niche players push the sustainable packaging agenda, Brand Owners are being forced to innovate and develop cost-effective sustainable packaging that continues to meet the barrier needs of the packaging they replace. Converters can meet this challenge by developing structures using biodegradable, renewable-resource based films such as PLA, with high barrier properties imparted by either SiOx or aluminum inorganic coatings.