



Refreshing the Array Tray

ICPG Case Study

Tasked with the mission of replacing a PVDC coated polystyrene material structure for an array tray/single-serve dip cup application, ICPG set out to formulate a polypropylene-based high-barrier material structure with the following requirements:

- Equal to or improved barrier protection
- Drop-in processing on customer forming equipment
- Fully recyclable & sustainable material solution.

Why replace polystyrene with polypropylene in food packaging applications?

Polystyrene has long been the material of choice for food packaging applications from single-serve condiments to yogurt multi-packs, for its ease of processing, low cost and proven mechanical properties. But lack of recycling options and health and safety concerns as a result of Proposition 65, have resulted in widespread initiatives to replace polystyrene in food packaging

So what's the solution?

ICPG's patent-pending XPP™ technology is an enhanced polypropylene formulation specifically designed and engineered to replace barrier polystyrene structures in thermoformed and form-fill-seal food packaging applications.

Designed to maintain all of the positive attributes of current commercial structures, XPP materials enhance current packaging solutions by providing:

- Enhanced barrier protection & extended shelf-life
- Maintains "snapable" feature for FFS
- Controlled shrinkage
- Fully recyclable solution [RIC #5]
- Enhanced stiffness
- Drop-in PS replacement on existing thermoforming & FFS systems & processes



- Improved organoleptic properties vs PS
- Satisfies PS Proposition 65 concerns
- Compatibility with existing PS tooling

Getting down to business:

To evaluate the suitability of ICPG's XPP technology in an array tray application, the following material structures & processes were evaluated:

ICPG Tested Material Solution: .0175" XPP High Barrier in natural and clear.

Control Commercial Structure: .015" white HIPS with single-sided PVDC coating.

Processing Conditions: Materials were processed on a ZED thermoforming machine using standard PP processing parameters.

Tooling: Standard PS array tray tooling.

Goal: To achieve a more sustainable part with improved barrier properties for shelf-life extension with minimal processing changes on existing equipment used to process PS.



We'll let the results speak for themselves:

ICPG's XPP Enhanced Barrier PP offers barrier performance in the form of a mono-material solution without the use of specialty materials or coatings. For high barrier shelf-stable applications, XPP High Barrier incorporates a layer of EVOH to achieve the required barrier performance and meet shelf-life requirements.

Barrier Performance - XPP Enhanced Barrier

XPP Enhanced Barrier was found to offer improvement in barrier properties in comparison to non-barrier PS rollstock, allowing for the reduction, or elimination, of high-cost barrier materials and shelf-life extension:

- OTR: Up to 100% improvement vs PS
- MVTR: Up to 150% improvement vs PS



Pictured: .0175" XPP Enhanced Barrier PP single-serve dip cups in clear and natural (contact clarity).

Barrier Performance - XPP High Barrier

To meet the barrier and shelf-life requirements for shelf-stable single-serve condiments, XPP High Barrier with a coextruded layer of EVOH was tested.

When comparing the OTR results of the XPP High Barrier to a commercial HIPS/PVDC cups, parts produced from ICPG's XPP High Barrier resulted in up to a 60% improvement in OTR barrier properties:

Material	OTR
HIPS	XX
PP	X
XPP	✓✓
HIPS/PVDC	✓✓✓
XPP/EVOH	✓✓✓✓✓

“Parts produced from ICPG’s XPP High Barrier resulted in up to a 60% improvement in OTR barrier properties...”

Processing

Traditional polypropylene structures have been avoided in applications like the array tray due to processing issues on existing platforms.

Trials conducted required minor setting adjustments and showed XPP material to overcome processing challenges typically observed with PP resulting in:

- Minimal shrinkage rate [1% across web]
- Minimal to no sag
- Smooth trimming for multi-packs

- Maintains “score” and “snap” similar to PS
- No reduction in through-put or cycle times

Enhanced Sustainability & Safety

Both versions of the XPP structures tested are fully recyclable using RIC #5. In comparison, comparable HIPS/PVDC structures are not easily recycled and must used RIC #7.

In addition, use of PP-based structure affords a number of sustainability and health & safety benefits vs HIPS including:

- Light-weight & low density
- Reduced fuel consumption
- Fewer emissions
- Proposition 65 compliant
- Improved organoleptic properties vs PS

The Proof is in the Dipping Cup

As a result of trials conducted, we can conclude that ICPG's XPP Enhanced Barrier PP material is a viable replacement for PVDC coated HIPS in array tray / single-serve dip cups and similar applications.

Results of the trial prove that XPP materials offer:

- Compatibility with existing platforms for drop-in processing on FFS & thermoforming lines.
- Fully recyclable solution with enhanced sustainability attributes.
- Improved barrier protection presenting opportunities for shelf-life extension