

# IMPROVE INK PRINTABILITY WITH UNIQUE ESTER DESIGN

A common issue in the plastics industry has been the application of high-polarity ink on low-polarity plastics. With a regulatory push away from solvent-based ink to water-based inks, plastics now need a much greater surface energy for acceptable printability (~40-44 dynes/cm<sup>2</sup>). PVC film using traditional plasticizers has a surface energy <30 dynes/cm<sup>2</sup>.

Hallstar has developed new high-performance ester plasticizers used to maintain excellent tensile properties while dramatically increasing the surface energy of PVC film. Using Hallstar plasticizers, instead of beading up, these high-polarity inks will wet out on the film improving the visual quality and adhesion of the print.

## Hallstar Products for Increased Surface Energy of a Substrate

- **Paraplex® A-7032:** High Loading Version (Typical 50-100 phr)
- **Paraplex® A-7040:** Low Loading Version (Max 20 phr)

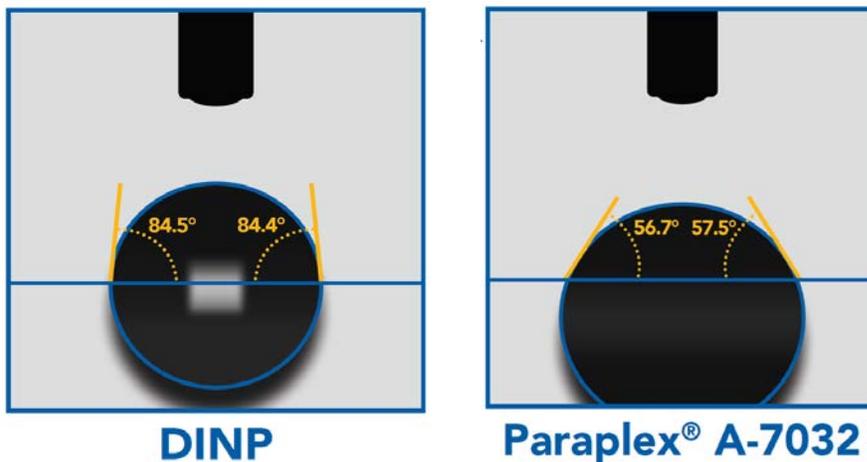


Image: Contact angle of a droplet of dH<sub>2</sub>O on PVC film. Using the contact angle between water and the substrate, we can quantify the surface energy. Hallstar uses a Goniometer to measure contact angle by ASTM D7334-08(2013). Comparing commodity ester(DINP) to unique Hallstar chemistry.

Paraplex® A-7032 provides a 27° reduction in contact angle, allowing for a significant increase in surface energy of the PVC substrate.

## Hallstar's PVC Film Formulation (used in Contact Angle Evaluations)

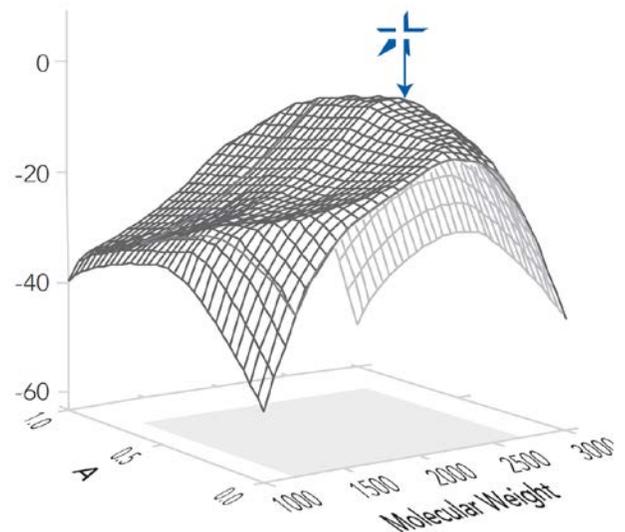
|                    |         |
|--------------------|---------|
| PVC Resin:         | 100 phr |
| Stabilizer(Ba/Zn): | 2.0 phr |
| Paraplex® G-62:    | 5.0 phr |
| Plasticizer:       | 67 phr  |



| Plasticizer                     | DINP  | Paraplex® A-7032 |
|---------------------------------|-------|------------------|
| Hardness                        | 72    | 76               |
| Modulus 100% (psi)              | 957   | 738              |
| Elongation at Break (%)         | 375   | 553              |
| Ultimate Tensile Strength (psi) | 2075  | 2374             |
| Viscosity (cps) @ 25°C          | < 100 | < 100            |

Hallstar has unrivaled expertise in all facets of ester chemistry, with decades of experience developing and commercializing innovative and unique ester technology. We are global leaders in design, synthesis and manufacture of a broad range of polymer modifiers for demanding industrial applications.

Hallstar can also design custom ester plasticizers using its proprietary Paraplex Approach. The Paraplex Approach is a molecular design system developed by Hallstar to characterize and synthesize plasticizer solutions for well-defined customer performance requirements. Through the use of existing performance data, application knowledge and the latest in computer technology, raw materials can be rapidly adjusted in precise combinations to create a plasticizer that solves critical performance issues.



## Technical Inquiries

Sean Neuenfeldt, Hallstar R&D-Polymer Modification,  
sneuenfeldt@hallstar.com