NOVA Chemicals
Polyethylene

Tech Bulletin
Gas Fading

Preventing Gas Fading in Polyethylene

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What is Gas Fading?

Gas fading is a yellow or pink discoloration that happens when atmospheric pollutants like nitrogen oxide gases react with phenolic-type antioxidants. It's a common issue with polyethylene films.

Even very low levels of NOx species can discolor an extruded film or molded article at any stage of the processing life cycle—extrusion processing, film fabrication, product handling, or storage.

Discoloration associated with gas fading differs from conventional discoloration in that the problem develops slowly over time during storage, not immediately after extrusion or conversion. The change in polymer color is strictly an aesthetic phenomenon that does not affect the polymer's physical properties.

Causes of Gas Fading

Several factors can increase a material's tendency to gas fade, including:

- Air quality (NOx, temperature, moisture)
- Migration of polyphenols from cardboard
- Presence of phenolic antioxidants
- Antagonistic additive interactions (e.g. UV Stabilizers, TiO2)

Note the significant yellowing of the gas-faded film roll on the left in comparison to the color of the non-gas-faded roll on the right.

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Preventing Gas Fading

An effective way to minimize gas fading discoloration is to eliminate or reduce the interaction of NOx pollutants with polyethylene articles:

- Limit or restrict the use of gas/propane powered forklifts and heating units
- Improve storage facility ventilation or change the storage location of vulnerable materials
- Use overwrap film as a barrier to atmospheric pollutants
- Use high-quality bleached or coated cardboard packaging materials (boxes, film rolls, etc.)

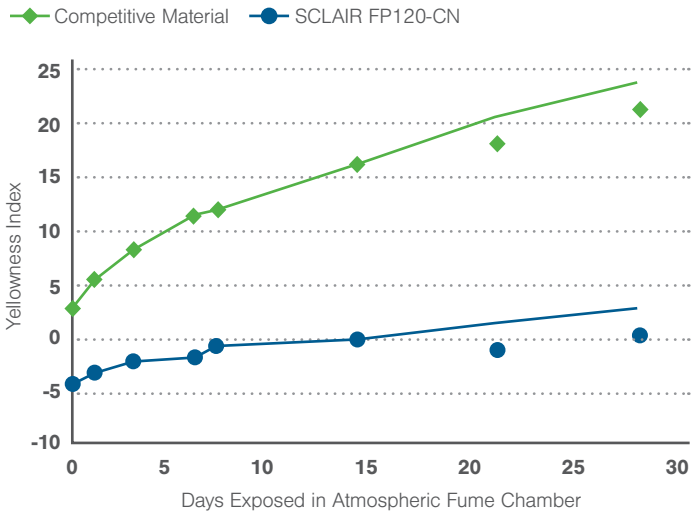
The most effective strategy is to remove the phenolic antioxidant from the stabilization system—an approach NOVA Chemicals adopted in developing their proprietary stabilization package for food packaging and industrial applications. SCLAIR® FP120-CN and FP020-D, NOVAPOL® TR-0338-E, and TF-0438-E resins use that stabilization system to provide excellent melt flow and color stability during the extrusion process without sacrificing film properties or appearance.

Mitigating Gas Fading

Where the solutions above cannot be implemented or fail to completely alleviate the problem of discoloration, consider the following remedies:

- Monitor resin degradation and the amount of recycled material incorporated into your process. Adjust process temperatures or additional stabilization as required.
- When your process requires added stabilization, use concentrates consisting exclusively of secondary antioxidant (phosphite) or those containing higher ratios of phosphite to phenolic antioxidant (e.g. 2:1 or 3:1)
- Try processing additives that are less antagonistic to gas fading, such as:
  - Phenolic antioxidants—while all are vulnerable to gas fading, some are less prone to discoloration.
  - Hindered amine light stabilizers (HALS)—highly alkaline products intensify discoloration.
  - Titanium dioxide—consider using rutile grades with higher levels of treat or surface coating.

Gas Fading Comparison



When in doubt, ask your technical service representative how to mitigate and resolve discoloration in your process.

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