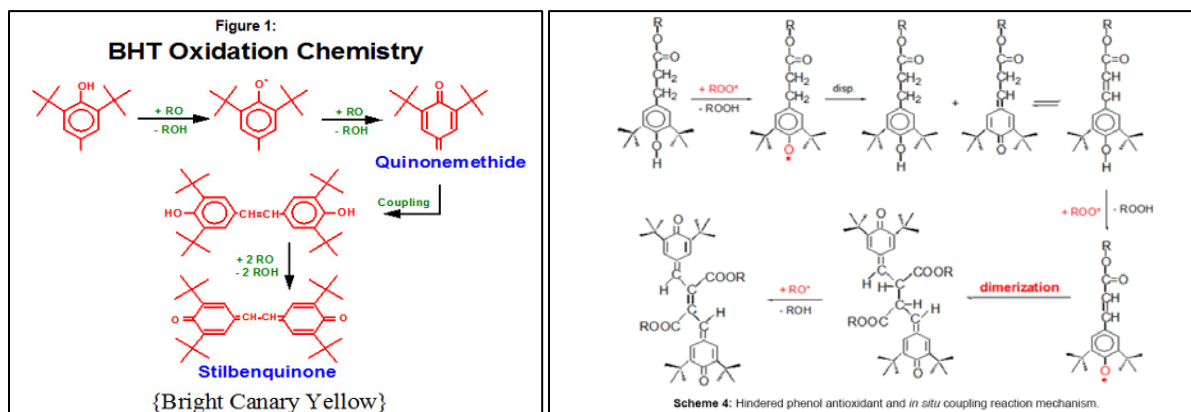


Effect of Transcrystallinity of Polypropylene Copolymer on Long Term Storage Yellowing

Discoloration of polyolefin plastics after fabrication has been a common problem historically. Post Storage of polyolefin plastics depending on storage conditions of temperature, conditions of light and darkness and the presence of prompt oxides of nitrogen will accelerate in-situ yellowing, In addition to these conditions oxygen diffusion from the top layers to inner layers of the plastic are rate dependent on crystallinity of the fabricated part. Although most polyolefin plastics today contain a primary and secondary antioxidant to control melt rheology and initial discoloration the conditions of processing temperature, residence times and conditions of storage will initiate chromophores over time. Some primary antioxidants are more prone to long term storage discoloration and initial processing discoloration.



Low Molecular Weight Antioxidants and High Molecular Weight antioxidants discolor over time.

Recently we were approached by a large packaging company to determine whether we could enhance their already nucleated polypropylene copolymer from Pinnacle designated 5110C3. This product contains a clarifier and considered by the customer to be the premier polypropylene for clarity.

Injection molded samples were prepared under their conditions of molding. Samples from 30 mils to 120 mil plaques were molded for study. Trans- crystallinity was induced on samples under the same conditions for comparison.

The following comparison between see through clarity of the control versus induced transcrystallinity are shown below:



Plaques on left is the Control Pinnacle 5110C3 and Sample on the right the same resin with induced trans-crystallinity under identical molding and cooling conditions.



Transmission was increased by 40% over the control after transcrystallinity. Percent Crystallinity significantly increased epitaxial to the plane of crystal growth making the surface properties harder and less prone to surface oxidation or staining.

After seventeen (17) months storage in the dark outside in cloth bags in sealed polyethylene zip lock bags the following discoloration was observed in the controls but not in any of the induced trans-crystalline parts.

The following photos were of 85 mil thick injection molded plaques cooled at 140F mold temperature.

All samples were of Pinnacle Polypropylene Copolymer Nucleated Grade 5110C3

Samples Molded on November 16, 2016

Indoor Photos



- Depending on lighting two shades of yellowing are shown

Outdoor Photo:



- Bright outdoor lighting

Conclusion: Due to trans-crystallinity the surface of the same molded parts do not yellow due to oxidation. Surface crystallinity clearly determined rate of oxidation of antioxidant present.

