

## **Antioxidants in Rubbers & Plastics (91S1)**

Antioxidants are used in virtually all synthetic rubbers and plastics to prevent polymer degradation, which may be initiated by heat, light, impurities such as catalyst residue, or mechanical stress. Synthetic rubbers are also particularly susceptible to degradation from ozone, and antiozonants are used as well. These two compounds may be identical in use, and in many instances a single compound performs both functions. Thus, it is impossible to ascertain and attribute the percentage of antioxidant or antiozonant activity in each product. Therefore, both inhibitors are included in this report, and may be considered antidegradants.

There is a wide range of synthetic rubbers and plastics that use antioxidants. For the purposes of this study, the polymers evaluated have been limited to those representing the major antioxidant consumers. The synthetic rubbers analyzed include solid SBR, polybutadiene, and ethylene-propylene-diene monomer. The plastics reviewed include the polyolefins (low density polyethylene, linear low density polyethylene, high density polyethylene, polypropylene) and the styrenics (polystyrene, acrylonitrile-butadiene-styrene). The antioxidants are classified into two types, primary and secondary, depending on the mechanism used to halt the degradation process. These classifications may be further segmented by chemical structure, as described in the report.

Secondary antioxidants stabilize polymers by reducing the hydroperoxides, which form alcohols. Primary and secondary antioxidants are often used together. Combinations of radical scavengers and hydroperoxide decomposers can have a synergistic effect.

Primary antioxidants represent almost 90 percent of the antioxidants identified in the study. This is principally due to the fact that synthetic rubber is the largest consumer of primary antioxidants, while consuming little secondary antioxidants. Demand for primary antioxidants used in the rubbers analyzed accounts for approximately 85 percent of the primary antioxidant use identified in the study. The remaining 15 percent of the primary antioxidants are used in selected plastics, principally polypropylene and HDPE. Overall global growth in primary antioxidant use will average 2.8 percent per year. However, growth in plastics applications will be more than twice that in synthetic rubbers.

The chemical structures and suppliers for both classes of antioxidants are covered in the report. Triregional (U.S., Europe, Japan) commercial data has been acquired and correlated. Profiles of the major producers are presented.