

**Recent research by Polymer Aging Concepts, Inc. shows that simple, low-cost conductive composite sensors precisely measure the state of virtually any degradable product.**



Nano-size particles of low-cost (electrically conductive) carbon black embedded with a tiny portion of the product polymer function as the sensor to track minute changes in the polymer as it ages. Alternatively, the sensor can be made of a "designed" conductive composite, which mimics the degradation characteristics of the product.

Research conducted on EPR, Silicone Rubber (SR), XLPE, and other polymers showed a dramatic change in electrical resistivity, which correlates to the product's degraded condition. When the electrical resistivity data was used in an Arrhenius plot, it actually predicted the remaining life of the polymer of interest.

Extensive research in cooperation with Georgia Tech indicates that AgeAlert accurately monitors the degradation state and predicts remaining life for EPR, silicone rubber and XLPE insulation; additionally, initial research indicates that the AgeAlert technology will monitor the degradation state of virtually any degradable product.

Currently, Polymer Aging Concepts is collecting market research on the many areas where AgeAlert *could* be used to determine the *best fit for the next major research effort*.

**What do all these items have in common? They all degrade faster with increasing temperature. Research conducted at Polymer Aging Concepts, Inc. and Georgia Tech indicates that the patent-pending AgeAlert technology can measure the degradation state for virtually any degradable product.**

## Applications

Potential applications for the AgeAlert technology include degradation monitoring for food, pharmaceuticals, serums, composite structures, building materials, adhesives, protective coatings, propellants, plastic and rubber tubing/piping, and wire/cable insulation.

## Features and Benefits

The benefits of the patent-pending AgeAlert technology include:

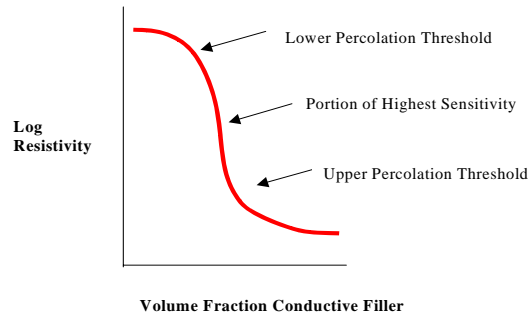
- Improved safety. AgeAlert accurately monitors the degradation of the product from *actual* use and storage conditions, allowing replacement before product failure.
- Reduced costs from product waste, premature replacement or unplanned shutdowns.
- Easy to use. AgeAlert provides *objective* results (good/bad, percentage degraded, *or* remaining life).
- Product flexibility. Multiple methods of product-sensor integration and sensor communication allow use with a wide range of products.
- Compatible with passive RFIDs. Simple resistance output requires no batteries and provides "life cycle" product identification *and* status.
- Low cost sensor. Use of low-cost carbon black results in very low sensor costs as compared to time-temperature integrators.

# AgeAlert Technology Update for General Products

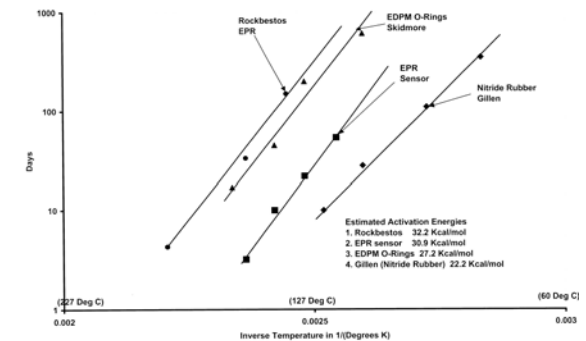
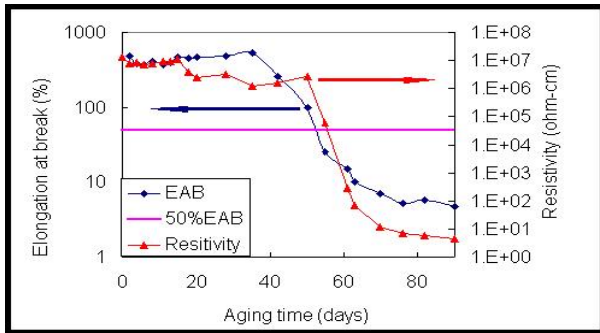
## How AgeAlert Works

AgeAlert™ is a low-cost conductive composite sensor, which precisely measures the degradation state of virtually any degradable product. As the product ages, the polymeric components of the product shrink very slightly. At the same time, the polymeric components of the AgeAlert™ sensor also shrink, precisely mimicking the changes in the product. AgeAlert™ essentially tracks the very minute change in shrinkage through change in electrical resistivity. For example, as a polymer ages, AgeAlert™ monitors how much the product has aged by monitoring the electrical resistivity in the sensor.

## Percolation Curve for Age Sensor




Minute changes in product polymer shrinkage during aging provides large changes in resistance output of the sensor.



As aging occurs, the polymer's resistivity correlates strongly with mechanical properties such as elongation at break for this sample of wire insulation. (Research conducted by GA Tech and Polymer Aging Concepts)

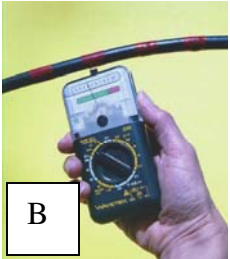
By using the Arrhenius equation, the change in electrical resistivity predicts remaining life of the polymer material.



A


**AgeAlert sensor communications can take many forms:**

- In photo (A), the sensor (top of container) attaches to the product packaging and is queried using a contact reader. (Note: simulated photo for illustration only)



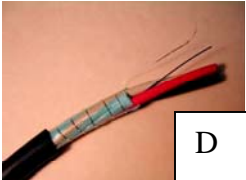
B

- In photo (B), the sensor, embedded in the outer layer of rubber, plastic, or composite structures can be queried using a contact reader (B).



C

- Combined AgeAlert sensor / RFID tag (C) can be integrated into the product, attached to the product or attached to the product packaging. The passive RFID tag communicates with remote (wireless) RFID reader.



D

- Sensor filament integrated into a polymeric product such as wire/cable insulation is direct-wired to a terminal box/reader (D).