The Pioneer Of Geosynthetics

S I N C E 1 9 7 2

Technical Note

Ultraviolet (UV) Resistance for Geomembrane Products

GSE geomembranes.

Weathering of geomembrane lining materials continues to be a major interest to those seeking long term protection against ultraviolet exposure. In general, weathering and other environmental effects which cause lasting material changes are classified as aging. Changes in a material can be determined by studying the changes in material's mechanical properties. Under certain conditions, a change in mechanical characteristics can permit an estimation of the material's life span.

GSE polyethylene geomembranes are manufactured from first quality polyethylene resins[1]. To combat causes of aging, such as ultraviolet exposure, properly selected and dispersed carbon black is added to GSE geomembranes at a rate of 2 - 3%. Carbon black is universally accepted as being resistant to significant deterioration caused by weathering for 50 years or more. In fact, AT&T Bell Laboratories (Polyolefin Longevity for Telephone Service, H.M. Gilroy, AT&T Bell Laboratories, ANTEC, '85) set out many years ago to demonstrate that the resistance to ultraviolet exposure and weathering for polyethylene is in excess of 45 years[2].

In addition to a high quality carbon black, GSE utilizes highly effective chemical UV stabilizers which further extend the life of the material to which it is added. These additives absorb incident radiation and/or terminate free radical production, thus protecting the polyethylene against thermal degradation and possible chemical reactions with surrounding materials. Polyethylene resins, chemical stabilization components and carbon black dispersions have all been improved as a result of research and testing. As a result, properly formulated and compounded polyethylenes have an estimated projected life in excess of 100 years for resistance to weathering.

Not only is the quality of additive packages important, but the integrity of the polyethylene resin itself plays a vital roll in UV resistance. There are various properties of the resin package which can be adjusted to improve the UV resistance of a material. It has been determined that reducing the density of the polyethylene base resin reduces both the weathering and chemical resistance of the resin and the effectiveness of chemical stabilizers and carbon black. It is GSE's current opinion that polyethylene resins below a density of about 0.915 g/cc are undesirable for use where dependable long-term weathering or chemical resistance is required.

There are, however, other factors which effect the potential UV resistance of a material and thus any lifetime predictions determined in a laboratory. Some items which effect or cause variation in the resistance of a material to UV degradation are:

- Average Density
- Carbon Black Type, Content and Dispersion
- Density Range or Distribution
- Chemical Stabilizer System
- Catalyst Type and Amount of Residue
- Copolymer Type
- Combined Chemical Exposures
- Failure Criteria

Essentially all liquid containment applications leave some portion of the slope liner exposed to weathering. Therefore proper resin and additive formulations are very important to enhance the material's resistance to UV degradation.

References:

[1]GSE Technical Note TN010, GSE Lining Technology, Houston, Texas, 1999.

[2]Gilroy, H.M., "Polyolefin Longevity for Telephone service", AT&T Bell Laboratories, ANTEC, 1985.

TN3 UVResistance R07/01/09

www.gseworld.com

This information is provided for reference purposes only and is not intended as a warranty or guarantee. GSE assumes no liability in connection with the use of this information. Specifications subject to change without notice.

GSE and other trademarks in this document are registered trademarks of GSE Lining Technology, Inc. in the United States and certain foreign countries.