

Stress Crack Resistance for Geomembrane Products

The stress crack resistance (SCR) of polyethylene (PE) geomembranes has been the subject of study since the introduction of the materials over 20 years ago. It is well known from the pipe and cable insulation industries that PE can stress crack over long periods of time. When the geomembrane industry began, this was recognized and SCR testing has been a standard specification and test ever since.

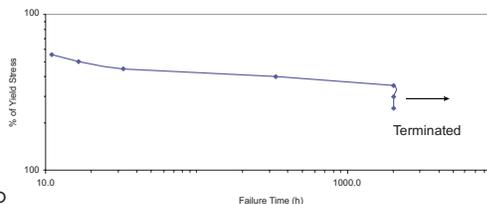
The first stress crack test method used was ASTM D 1693. This so-called “bent strip” test was able to differentiate the first resins used to manufacture geomembranes. However, advances in resin technology have increased the SCR of polyethylene higher than the level that can be tested via ASTM D 1693. As a result ASTM D 5397 was developed. Today, the most common test method used to determine SCR is ASTM D 5397, “Standard Test Method for Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test¹”. This is referred to as the “NCTL” test.

This test method subjects specimens to varying constant tensile loads. Small dogboneshaped specimens are loaded at 20-50% of the tensile yield strength of the material. The specimens are notched 20% of their overall thickness and placed in a bath containing 10% surfactant at 50° C. In this accelerated aging test, the time to failure is measured. The data are reported in a plot of load vs. failure time. A NCTL test provides information on both the ductile and brittle failure mode of the material. It is the transition between these two failure mechanisms that indicates the SCR of the material².

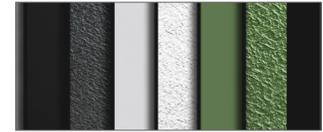
Note: Currently, there has not been a correlation study performed to relate such test results to actual field performance; D 5397 is an index test.

NCTL testing has been performed on standard GSE HDPE geomembranes and GSE High Performance geomembrane materials by the Manufacturing Quality Assurance Laboratory at GSE. GSE HDPE geomembranes exceed the requirements of 300 hours per the industry standard of GRI-GM13.

The graph shows data obtained on one NCTL test for GSE High Performance HDPE. Because there is not a break in the curve, the ductile-brittle transition was not reached within the 2000 hour exposure time. The extremely high SCR of GSE High Performance HDPE geomembranes is due to the great amount of research performed by GSE and particular resin suppliers. The goal of the research was to develop a product that demonstrates the highest SCR of any geomembrane in the industry.



Note: the 10%, 20%, and 30% sample were removed after 2,000 hours from testing prior to failure.



GSE Geomembrane



GSE Textured HDPE

HDPE Geomembrane

An HDPE geomembrane used in applications that require excellent chemical resistance and endurance properties.

References:

- ¹ASTM D 5397-99, volume 4.09, American Society for Testing and Materials, West Conshohocken, PA, 1999.
- ²Ferry, John D., Viscoelastic Properties of Polymers, John Wiley & Sons, New York, NY, 1980.
- ³Geosynthetic Institute, Geosynthetic Institute Test Methods and Standards, Philadelphia, PA.

GSE is a leading manufacturer and marketer of geosynthetic lining products and services. We've built a reputation of reliability through our dedication to providing consistency of product, price and protection to our global customers.

Our commitment to innovation, our focus on quality and our industry expertise allow us the flexibility to collaborate with our clients to develop a custom, purpose-fit solution.

[DURABILITY RUNS DEEP] For more information on this product and others, please visit us at GSEworld.com, call 800.435.2008 or contact your local sales office.

