The Pioneer Of Geosynthetics

S I N C E 1 9 7 2

Technical Note

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 Test[1]". This is referred to as the "NCTL" test.

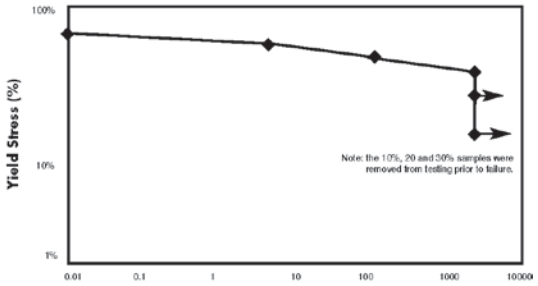
This test method subjects specimens to varying constant tensile loads. Small dogbone-shaped specimens are loaded at 20-50% of the tensile yield strength of the material. The specimens are notched 20% of their overall thickness and placed in a bath containing 10% surfactant at 50° C. In this accelerated 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 material[2].

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 GSE HDPE geomembrane materials by the Manufacturing Quality Assurance Laboratory at GSE. Results indicate a ductile-brittle transition time in excess of 2000 hours. (The exposures were not taken to completion because of equipment capacity limitations.) The graph shows data obtained on one NCTL test. Because there is not a break in the curve, the ductile-brittle transition was not reached within the 2000 hour exposure time. The common specification in the industry today, GRI GM -13[3], has a ductile-brittle transition requirement of 200 hours. It is therefore apparent that GSE HDPE geomembranes exhibit outstanding SCR.

The extremely high SCR of GSE geomembranes is due to the great amount of research performed by GSE and particular resin suppliers. The goal of the research was to develop resin that demonstrates the highest SCR of any resin in the geomembrane market. That goal has been achieved.

NCTL of GSE HDPE Geomembrane



References:

[1]ASTM D 5397-99, volume 4.09, American Society for Testing and Materials, West Conshohocken, PA, 1999.

[2]Ferry, John D., Viscoelastic Properties of Polymers, John Wiley & Sons, New York, NY, 1980.

[3]Geosynthetic Institute, Geosynthetic Institute Test Methods and Standards, Philadelphia, PA.

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