



Geocell Longevity

Environmental stress crack resistance (ESCR) of polyethylene (PE) material has been important to the overall integrity of geomembrane since the introduction of these materials over 40 years ago. It is apparent in the geotechnical industry that PE can stress crack over a period of time, which will significantly reduce the strength of a product over its lifespan. This was recognized within the early stages of the geomembrane industry, thus making ESCR testing a standard specification 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 geomembrane. However, advances in resin technology have increased the ESCR of polyethylene to levels beyond those that able to be tested via ASTM D 1693, resulting in the development of ASTM D 5397. Today, the most common test method used to determine ESCR is ASTM D 5397, “Standard Test Method for Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test”.

ASTM D 5397 is performed on all well-established geotechnical products. Supported by the extensive research, papers, and test procedures that have been created around this knowledge, this test method is vital to determining a product's lifespan. One particular paper is the Durability of HDPE Geomembrane by R. Kerry Rowe*, Henri P. Sangam. Environmental Stress Cracking is the central objective of the paper, as it speaks to all of the mechanisms that can cause degradation.

An additional concern to address when considering PE materials is UV degradation. Carbon black is traditionally added to help stabilize these products as well as a few others. One test that is used to test this is ASTM D5885 “Standard Test Method for Oxidative Induction Time of Polyolefin Geosynthetics by High-Pressure Differential Scanning.” This test looks at the antioxidants in the material and how quickly they are removed by oxidation. It is imperative to note that ASTM D5885 is not a design life test, but instead used for other purposes such as manufacturing control, research and development. Section 5.3 of ASTM D5885 states, “This test method is intended as a geosynthetic test. Use of the OIT value to estimate the lifetime of the geomembrane from which the test specimen is taken is not addressed, nor shall it be used for this purpose.” Respectfully, this test method is not used in making design usability determinations.

When examining PE materials that are going to be buried under soil or covered, oxidation is not typically considered a concern, as the presence of oxygen is required for the process to take place. Therefore, ASTM D5885 is not used if the product will be buried, however Environment Stress Cracking Resistance remains relevant for the buried product, as it is the most relied-upon test within the industry to help predict the lifespan of a material. It is also important to note that recycled plastic resin typically preforms poorly for ESCR and therefore most high-quality products will be made with virgin resin.