

WHAT IS CARBON BLACK?

Carbon black is the product of incomplete combustion of heavy petroleum. In the geosynthetics industry, it is used as an additive to provide geomembranes a resistance to UV. It is also the additive behind geomembranes' well-established black color. Due to its low electrical resistivity, carbon black is also used to enhance the conductive properties of certain materials. As part of typical Manufacturing Quality Control (MQC), carbon black content and carbon black dispersion tests are performed as per ASTM D-4218 and ASTM D-5596. These tests are critical in validating the resistance of liners to UV exposure.

HOW IS CARBON BLACK MEASURED IN PE GEOMEMBRANES?

The Geosynthetics Research Institute is the regulating authority for best practices and standards in the geosynthetics industry. It has established long-standing specifications for HDPE and LLDPE Geomembranes known as the GM-13 and GM-17 respectively. The GRI's Standard specifications constitute the world's most stringent set of minimum technical requirements for polyethylene geomembranes. These specifications are mostly based on testing standards developed by the American Society for Testing and Materials commonly known as ASTM. Geosynthetics and geomembranes are regulated under ASTM D35 and ASTM D35.10 respectively.

While there are different test methods that allow for proper testing of carbon black content, the GRI standards have determined that the best practice for this measurement is the Muffle-Furnace technique (ASTM D 4218).

Due to its practicality, cost and time requirements, the Muffle-Furnace technique consists of "baking" a sample of polyethylene compound in an oven until all that remains is the carbon black. It was developed under ASTM D20 in charge of testing of Plastics.



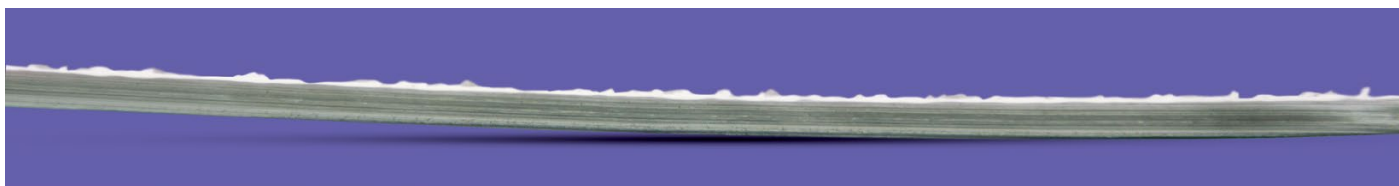
The GRI specifications for acceptable limits of carbon black content are in the range of 2-3% of the total weight of the tested compound. Research and extensive testing have demonstrated that this range of carbon black ensures proper UV resistance without compromising the mechanical properties.



WHY SHOULD CARBON BLACK BE MEASURED DIFFERENTLY IN MULTILAYERED GEOMEMBRANES?

Since the principle of the muffle-furnace technique is to pyrolyze polyethylene so that only the residual carbon black can be weighed, the conventional testing method can prove challenging for multi-layered geomembranes such as colored and conductive-backed liners.

In the case of colored geomembranes such as reflective geomembranes, following the pyrolysis, the residual material weighed in the dish is a combination of carbon black and titanium dioxide. As for conductive-backed geomembranes, the weighed residual material is carbon black but in ranges that can sometimes be outside of the ranges of the GRI-GM 13 and GRI-GM 17 specifications.



This phenomenon has led many engineers and users of multilayered geomembranes to question the compliance of these products to specifications. In effect, an excess of carbon black within the core layer of PE liners can consist of impurities that impact their mechanical properties.

However, the GRI specifications as well as the ASTM standards were developed for black geomembranes and are not applicable to compositions that contain non-volatile pigments or fillers other than carbon black.

Furthermore, the GRI-GM 13 and GRI-17 specifications clearly state that the specifications are possibly not adequate for the complete specification in a specific situation and as such, additional tests may be necessary under the conditions of a particular application.

To further address this concern, manufacturers, specifically the ones using the blown-film extrusion process, do comply with the GRI-GM 13 and GRI-17 by using the core layer of the material as a reference point, when sampling their products for testing purposes. Sampling the core can mean grinding the finish layer of the geomembrane or taking samples from the smooth edges. The relevance of these sampling methods lies in the fact that colored layers and conductive-backing are finishes that do not define the mechanical or the durability properties of the geomembrane nor are they representative of its long-term performance.

With the collective efforts of experts from the geosynthetics and plastics industry, the ASTM is currently working on reviewing several standards that were initially created to suit the needs of the plastics and piping industries and adapt them to the needs of the geosynthetics and geomembranes industries.

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