Polymer Sciences
ISSN: 2471-9935

Open access Perspective

Model and Mechanical Properties of Polyvinyl Chloride Geomembrane

R Kerry Rowe*
Department of Chemical Engineering, National Research Institute of Science and Technology, France

INTRODUCTION

The mechanical characteristics in axial tension of Polyvinyl Chloride (PVC) Geomembrane (GEM) were investigated by experiment and theoretical analysis with the goal of determining the mechanical response of Geomembrane (GEM) in Membrane-Faced Rockfill Dam (MFRD) to various ambient temperatures. First, in the temperature environment laboratory, 15 groups of axial tensile tests for longitudinal and transverse specimens were carried out at various temperatures. The stress-strain curve and Young's modulus were then obtained, and the variation of Young's modulus with temperature was examined using Boltzmann function fitting. Second, the Thermomechanical Analyzer (TMA) thermodynamic test was used to determine the glass transition temperature of PVC GEM, and Differential Scanning Calorimetry (DSC) was used to determine the differences in mechanical characteristics between longitudinal and transverse specimens of PVC GEM. The findings demonstrated that the Young's modulus increased with decreasing temperature while the linear interval of stress and strain decreased and increased with increasing temperature. The ambient temperature has an impact on the differences in mechanical characteristics between the two orientations. According to a theoretical investigation, the variation in mechanical characteristics is due to the orientation of the polymer structure. For numerical simulation, the Boltzmann function fitting outcomes have a specific reference value.

The ambient temperature should be thoroughly taken into account while designing the membrane impermeable structure in the MFRD, and longitudinal/transverse welding splicing should be avoided wherever feasible. Instead of testing and evaluating the quality at a single temperature, the present test standard shall examine the mechanical performance of GEM at the reservoir's typical operating temperature. To prevent impermeable structures' performance from being harmed and to preserve their service life, the temperature needs to be taken into account in its whole during construction.

DESCRIPTION

Due to its exceptional flexibility, high adaptation to deformation, and low permeability, Polyvinyl Chloride (PVC) Geomembranes (GMBs) have been used in Membrane Fronted Rockfill Dams (MFRDs) as anti-seepage materials. They exhibit time-dependent stress drops under continuous strain and have a nonlinear stress-strain behaviour that varies on strain rate (i.e., stress relaxation). Testing may be done by applying a continuous strain and measuring the associated stress needed to sustain the deformation as a function of time. The stress relaxation behaviour plays a crucial influence in the mechanical characteristics of PVC GMBs. The GMB is installed at the MFRD's peripheral joints with one end on the dam surface and the other end attached to the dam abutment's plinth or the top of the concrete anti-wall. This arrangement relies on interface friction to provide stability under water stress. The GMB at the peripheral joints is vulnerable to substantial tensile deformation as a result of the differential displacement between the dam body and abutment, whereas the GMB on the dam surface can typically handle the local minor deformation at the bottom of the gravel cushion. The anti-seepage construction is vulnerable to failure because of the tensile deformation, which mostly occurs during the reservoir's initial impoundment and operation.

The GEM is an organic polymeric substance that is commonly broken down into rubber, polyethylene, and poly (vinyl chloride). While rubber is primarily Thermoplastic Polyolefin (TPO), poly (vinyl chloride) is primarily soft PVC, and GEM at home and abroad is selectively combined with engineering experience

Received:	02-January-2022	**Manuscript No:**	IPPS-23-15676
Editor assigned:	04-January-2022	**PreQC No:**	IPPS-23-15676 (PQ)
Reviewed:	18-January-2022	**QC No:**	IPPS-23-15676
Revised:	23-January-2022	**Manuscript No:**	IPPS-23-15676 (R)
Published:	30-January-2022	**DOI:**	10.36648/2471-9935.23.8.002

Corresponding author R Kerry Rowe, Department of Chemical Engineering, National Research Institute of Science and Technology, France, E-mail: roke@r.fr

Citation Rowe RK (2023) Model and Mechanical Properties of Polyvinyl Chloride Geomembrane. J Polymer Sci. 8:002.

and development, for instance, Europe and the United States choose PVC in large quantities, the most common types of polyethylene that are used in China are PE, HDPE, and LDPE membranes. PVC GEM was first widely used in China, but PE/HDPE membrane eventually took its place. PVC GEM has been used as an impermeable material in medium-high dams and dams with a significant overburden layer in recent years. According to the incomplete statistics provided by the International Committee on Dams in 2010, out of the 216 large earth-rock fill dams that chose to use GEM as their impervious structure, 143 chose PVC membranes, making up roughly 60.3% of all membrane impervious dams. Some dams also chose to use exposed PVC membrane to prevent seepage. By modifying the kind and proportion of plasticizer, PVC GEM can retain good flexibility at low temperatures while PE/HDPE GEM struggles to keep its flexibility at normal temperatures. Although the flexibility of PE/HDPE is decreased as material thickness increases, the flexibility of PVC GEM is mostly unaffected. Because of its remarkable resistance to significant deformation and high durability, PVC is used widely.

CONCLUSION

The MFRD's upstream face is where the impervious construction is placed, and the GEM serves as its primary impervious component. 15 experiments were carried out on the mechanical characteristics of PVC GEM in axial tension in response to ambient temperature, disregarding the influence of concrete slope above the membrane on heat conduction, and the stress-strain relationship of the longitudinal and transverse specimen was determined. The difference between the relationship curves was examined using both thermodynamic tests (DSC and TMA) and theoretical analysis. The findings show how the mechanical characteristics of PVC GEM change in response to temperature.