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Maintaining Experimental Consistency in Geomechanical Studies of Methane Hydrate Bearing Soils

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Abstract : Methane hydrate has been found in significant quantities in soils offshore within continental margins and in permafrost within arctic regions where low temperature and high pressure are present. The mechanical parameters for geotechnical engineering are commonly evaluated in geomechanical laboratories adapted to simulate the environmental conditions of methane hydrate-bearing sediments (MHBS). Due to the complexity and high cost of natural MHBS sampling, most laboratory investigations are conducted on artificially formed samples. MHBS artificial samples can be formed using different hydrate formation methods in the laboratory, where methane gas and water are supplied into the soil pore space under the methane hydrate phase conditions. The most commonly used formation method is the excess gas method which is considered a relatively simple, time-saving, and repeatable testing method. However, there are several differences in the procedures and techniques used to produce the hydrate using the excess gas method. As a result of the difference between the test facilities and the experimental approaches that were carried out in previous studies, different measurement criteria and analyses were proposed for MHBS geomechanics. The lack of uniformity among the various experimental investigations may adversely impact the reliability of integrating different data sets for unified mechanical model development. In this work, we address some fundamental aspects relevant to reliable MHBS geomechanical investigations, such as hydrate homogeneity in the sample, the hydrate formation duration criterion, the hydrate-saturation evaluation method, and the effect of temperature measurement accuracy. Finally, a set of recommendations for repeatable and reliable MHBS formation will be suggested for future standardization of MHBS geomechanical investigation.

Keywords : experimental study, laboratory investigation, excess gas, hydrate formation, standardization, methane hydrate-bearing sediment
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