



Contents lists available at ScienceDirect

International Journal of Pressure Vessels and Piping

journal homepage: www.elsevier.com/locate/ijpvp

Editorial Special Issue on SENT Fracture Toughness Testing and Applications to Modern Pipelines



This special issue on fracture toughness testing and applications to modern pipelines using single edge notched tension (SENT) specimens aims to provide a technical platform to present recent results with regard to development and progress of SENT fracture toughness test methods and applications. Fracture toughness is an important material property in fracture mechanics methods and has been used for materials selection, engineering critical analysis, fitness for service evaluation and structural integrity assessment. Traditional fracture toughness test methods as specified by American Society for Testing and Materials (ASTM) or British Standards Institution (BSI) were developed for bending dominant specimens to determine lower-bound fracture toughness. For modern pipeline steels, however, both material strength and fracture toughness are high, and the standard lower-bound fracture toughness can be overly conservative for application to real cracks in pipelines. In order to reduce conservatism, the oil and gas industry has favored the use of SENT toughness in the strain-based design and structural integrity assessment of pipelines so as to save material and maintenance costs. While BSI recently published a SENT test standard BS 8571, ASTM work is ongoing on its standardization of SENT testing and facing challenges of consensus on experimental technology and evaluation methodology. Therefore, internationally recognized experts from different countries, including Belgium, Brazil, Canada, UK and USA, were invited to make contributions to this special issue, and eight papers were finally accepted with regard to SENT test methods, test procedures, experimental evaluation, validation and challenges so as to improve SENT toughness testing standardization and applications.

The first paper by Dr. Moore and Mr. Pisarski summarizes the current status of the SENT testing standard BS 8571 since its publication and the changes planned for its ongoing development.

The second paper by Dr. Park et al. reviews the CANMET SENT test method and applications in comparison with other existing procedures and updating experimental evaluation equations for J - R curve measurements.

The third paper by Dr. Panico et al. summarizes the ExxonMobil SENT test procedure using a double clip gage approach for measuring a Crack Tip Opening Displacement (CTOD) resistance curve and its application to strain-based design of pipelines.

The fourth paper by Prof. Ruggieri presents a brief review of current progress in fracture resistance test procedures to measure low-constraint fracture toughness using SENT and single edge notched bend (SENB) specimens in terms of J -integral and CTOD resistance curves.

The fifth paper by Dr. Zhu presents a more detailed technical review of existing SENT test methods focused on experimental evaluations for the DNV practice, CANMET procedure, ExxonMobil method and BS 8571 standard as well as recent progress with comparisons and suggestions for further studies.

The sixth paper by Mr. Weeks reviews the measurement techniques and processes of existing SENT test methods, and provides further guidance on specific techniques and processes with respect to uncertainty for standardized SENT testing of line pipe steels.

The seventh paper by Dr. Minnebruggen et al. describes the direct current potential drop technique using experimental and numerical approaches for determining crack growth measurement in a single SENT specimen test.

The eighth paper by Dr. Hioe et al. describes the direct current electrical potential method to measure crack extension during a single SENT specimen test with comparison of the unloading compliance results.

The guest editors would like to express their gratitude to Professor Robert Ainsworth, the Editor-in-chief of International Journal of Pressure Vessels and Piping, for offering us the opportunity to publish this special issue and for his invaluable advice and help in paper solicitation, review and organization. We hope this special issue provides a useful source of information on SENT testing and applications for researchers and engineers in the fracture mechanics community and in the oil and gas industry.

Fellow of ASME

Xian-Kui Zhu, Dr.

Edison Welding Institute, Columbus, Ohio, USA

E-mail address: xzhu@ewi.org

Timothy Dash Weeks, Mr.

National Institute of Standards and Technology, Boulder, Colorado, USA

E-mail address: timothy.weeks@nist.gov