UPM FORUM
UPSTREAM PRODUCTION MEASUREMENT

UPM 17010

Highly Accurate Pressure and Differential Pressure Sensors for HPHT Environments

Nick Tiliakos, Invoneering; James E. Hall and Ron Foster, Letton Hall Group; Tim Worst, Measurement Ltd., and Joe Brown, Letton Hall Group

Abstract

Using funds provided by the Research Partnership to Secure Energy for America (RPSEA), the Letton Hall Group, Innoveering and its team partners have developed a high-pressure, high-temperature (HPHT) sensor suite that includes an absolute pressure sensor and a differential pressure (DP) sensor for use in ultra-deepwater and downhole measurement applications (multiphase and wet gas flowmeters). Current DP sensor measurements (for downhole and ultra-deepwater applications) may be made with two absolute pressure sensors, which do not provide the required accuracy at these HPHT conditions, and also do not provide a HPHT DP measurement.

A novel, high pressure (22,500 psia), high temperature (250 °C), high accuracy differential pressure sensor was designed, fabricated and tested by our team. The team also developed and fabricated a specially-designed electromechanical silicon (MEMS) bridge circuit to provide the HPHT differential pressure-sensing element. This was incorporated into a pressure cell for eventual integration into high-pressure flowmeter housings. After intense R&D and continued technology development the team is ready to present the results of its experimental and metrology testing. Metrology activities included assessment of the various sensor components before and after welding and comparison of designs to “as-built” configurations. In addition, we will present: (i) calibration results up to and exceeding 10,000 psia and (ii) DP sensor performance tests with and without remote seals. Results for both our absolute and differential pressure sensors will be discussed.