OTC 2013 - Integrity Management Section

Evaluation of Underwater Adhesives and Friction Coatings for In Situ Attachment of Fiber Optic Sensor System for Subsea Applications

Henry H. Tang
MEI Technologies, Inc. (NASA JSC Engineering and Science Contract Group)

Suy Q. Le, Evelyne S. Orndoff, Frederick D. Smith, Alma S. Tapia
NASA Johnson Space Center

David V. Brower
Astro Technology, Inc.

ABSTRACT

Integrity and performance monitoring of subsea pipelines and structures provides critical information for managing offshore oil and gas production operation and preventing environmentally damaging and costly catastrophic failure. Currently pipeline monitoring devices require ground assembly and installation prior to the underwater deployment of the pipeline. A monitoring device that could be installed in situ on the operating underwater structures could enhance the productivity and improve the safety of current offshore operation. Through a Space Act Agreement (SAA) between the National Aeronautics and Space Administration (NASA) Johnson Space Center (JSC) and Astro Technology, Inc. (ATI), JSC provides technical expertise and testing facilities to support the development of fiber optic sensor technologies by ATI. This paper details the first collaboration effort between NASA JSC and ATI in evaluating underwater applicable adhesives and friction coatings for attaching fiber optic sensor system to subsea pipeline. A market survey was conducted to examine different commercial-off-the-shelf (COTS) underwater adhesive systems and to select adhesive candidates for testing and evaluation. Four COTS epoxy based underwater adhesives were selected and evaluated. The adhesives were applied and cured in simulated seawater conditions and then evaluated for application characteristics and adhesive strength. The adhesive that demonstrated the best underwater application characteristics and highest adhesive strength were identified for further evaluation in developing an attachment system that could be deployed in the harsh subsea environment. Various friction coatings were also tested in this study to measure their shear strengths for a mechanical clamping design concept for attaching fiber optic sensor system. A COTS carbide alloy coating was found to increase the shear strength of metal to metal clamping interface by up to 46 percent. This study provides valuable data for assessing the feasibility of developing the next generation fiber optic senor system that could be retrofitted onto existing subsea pipeline structures.