Disbonding Apparatus for ASTM G146

Automated Apparatus for Performing Hydrogen Induced Disbonding Tests for ASTM G146

Parr Instrument Company has developed an automated reactor system capable of attaining the conditions necessary for treating samples consisting of bimetallic plate typically used in refinery high pressure/ high temperature (HP/HT) hydrogen gas service.

The test temperature and hydrogen gas pressure are selected to simulate those conditions found in refinery hydrogen-containing environments. These typically range from 14 to 20 MPa hydrogen gas pressure and temperature from 300 to 500 °C depending on actual refinery service conditions under consideration.

The purpose of this test scheme is to allow for comparison of data among test laboratories on the resistance of bimetallic stainless alloy/steels to hydrogen induced disbonding (HID). This test procedure provides an indication of the resistance or susceptibility, or both, to HID of a metallurgically bonded stainless alloy surface layer on a steel substrate due to exposure to hydrogen-containing gaseous environments under HP/HT conditions.

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This system can be used over a broad range of pressures, temperatures, cooling rates, and gaseous hydrogen environments where HID could be a significant problem. These tests can be used to assess the effects of material composition, processing methods, fabrication techniques, and heat treatment as well as the effects of hydrogen partial pressure, service temperature, and cooling rate. This testing regime is fully described in ASTM Standard Practice G146.

The apparatus developed by Parr consists of a high pressure, high temperature test cell made from Inconel 625. Two gas booster pumps, one for nitrogen and the other for hydrogen, are used for pressurizing the test cell.

The system incorporates an automated back pressure regulator and a variety of automated valves for pressure control. The control system (not pictured) for the apparatus automatically purges the vessel with argon, performs a high pressure leak test with nitrogen and then sequences the main portion of the test. The main test consists of filling the test cell with hydrogen, heating the vessel at a user defined temperature set point for a period of typically 48 hours. After this, the vessel is cooled at a predefined rate, typically 150 °C/hr, until the inside temperature reaches 200 °C. The test cell is then automatically vented, purged and cooled further so that the test samples can be safely retrieved. All important test parameters are user adjustable.

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