A bright future ahead of Hydrogen

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Hydrogen is the most environmentally friendly carrier of energy: when consumed it solely emits water. Energy carrier means that its potential role has similarities with that of electricity. Both hydrogen and electricity can be produced by means of various energy sources and technologies. Both are versatile and can be used in many different applications. No greenhouse gases, particulates, sulfur oxides or ground level ozone are produced from the use of either hydrogen or electricity. Consequently, hydrogen is currently enjoying unprecedented political and business momentum, with the number of policies and projects around the world expanding rapidly; in July 2020, EU Commission adopted a new dedicated strategy on hydrogen in Europe: the strategy explores actions to support the production and use of clean hydrogen, focusing in particular on the mainstreaming of renewable hydrogen.

The transport of gaseous hydrogen through pipelines is not a novel concept. It has been indeed realized by use of mild carbon steel for almost a century and it is estimated that there are over 4,500 km of hydrogen linepipes in operation worldwide. Typical pipeline size is 300mm or less, manufactured with X52 or lower strength steels and in comparison to natural gas, H2 pipelines normally operate at relatively conservative conditions. However, owing to the low volumetric energy density of hydrogen (0.0108 MJ/L) in comparison to natural gas (0.0364 MJ/L) and the forecasted expansive utilization of renewable energy sources mentioned in section 1, it will be necessary to transmit hydrogen at high pressures using large size pipelines in order to be financially competitive. The combination of high pressure and large size pipe demands the use of higher strength steels… Read more about our technical article on Hydrogen transportation pipes, on the latest issue of World Pipelines (pages 47-52): https://bit.ly/3mpgAJw

RESULTS AT A GLANCE

- **Corinth Pipeworks SA organized a series of fracture toughness tests in high pressure 100% hydrogen environment for HFW and SAWL pipes in API 5L grades X60M to X70M.**
- **The testing protocol followed the qualification requirements of hydrogen pipe code ASME B31.12 Option B (qualification of the material threshold stress intensity factor K_{IH}).**
- **All tests were performed in RINA high pressure laboratory at a hydrogen test pressure of 80bar and varying applied stress intensity factors 110-145 MPa·$\sqrt{m}$.**
- **Following a test exposure of 1000h, all parent material, weld and HAZ specimens presented an excellent resistance to hydrogen embrittlement showing no measurable crack propagation from the fatigue pre-crack front.**
- **Based on the results, a K_{IH} value of 55 MPa·$\sqrt{m}$ and above was established in all cases, fulfilling the minimum qualification criteria of ASME B31.12 Option B**