Deutscher Verein des
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DVGW Project SyWeSt H2: “Investigation of Steel Materials for Gas Pipelines and Plants for Assessment of their Suitability with Hydrogen”

Final Report

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Summary

In connection with the construction of new high-pressure gas pipelines or their conversion, the suitability of the materials used within the context of complex fracture-mechanical investigations has to be evidenced in line with the DVGW Code of Practice, depending on pipeline design and the materials used. In order to simplify this currently necessary process, the DVGW initiated the SyWeSt H2 research project whose objective was to investigate the fracture-mechanical material behaviour of the steel grades in use.

As part of this project, fracture-mechanical tests were performed on a representative cross-section of typical pipeline steel grades used in Germany (and, in some cases, elsewhere in Europe). With respect to all tested pipeline steel grades, the investigations demonstrated their suitability for hydrogen transmission since both the stipulated minimum fracture toughness was adhered to and crack growth behaviour corresponded to the expected values.

In comparison to ASME B 31.12, it was possible to extend the scope of application with regard to the description of crack growth. This particularly relates to the additional introduction of the influence of both mean stress and hydrogen pressure on crack growth.

Due to the established relatively low-level scatter for crack growth in materials of a different strength and a very different age, it can be concluded that comparable materials which were not tested in this project are covered by the test results. Thus, the intended objective of the SyWeSt H2 research project was achieved for the group of pipeline steel grades and the pipeline steel grades used in plants.

Because the test programme necessarily focussed on steel grades used in pipelines and plants, only a few materials which are normally used for valve housings could be tested. These tests also predominantly demonstrated the suitability of the materials involved for use with hydrogen. Since the range and possible microstructures of these frequently cast materials could, however, not be covered by the research project by a long way, it is recommended to perform further tests, at least for this group of materials.

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