

Study on the influence of hydrogen permeation on the performance of pipeline internal coating

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Abstract In order to further explore the effect of hydrogen permeation on the performance of pipeline inner coating, electrochemical hydrogen permeation method was used to study the hydrogen resistance of liquid epoxy coatings. visual inspection and three-dimensional ultra-depth microscope were used to observe the effect of hydrogen charging on the surface morphology of coatings, and the pulling method was used to test the adhesion of coatings. and the hydrogen permeation and permeability coefficient of coating were tested by differential pressure method. The results show that the hydrogen diffusion coefficient of coated steel is much greater than that of bare steel, indicating that the coating can improve the hydrogen resistance of steel. However, with the progress of electrochemical hydrogen charging, obvious bubbling appeared on the surface of coating, and as the hydrogen charging time increased, the bubbling became more serious, the coating/steel interface was destroyed, and the adhesion of coating was significantly reduced. The hydrogen permeation and permeability of the coating were obtained by differential pressure method.

Keywords Internal coating, electrochemistry, hydrogen permeation, hydrogen resistance

Reference

[1] Crabtree, G W., & Dresselhaus, M S. (2008). The hydrogen fuel alternative. MRS Bulletin, 33(4), 421–428. doi:10.1557/mrs2008.84.

[2] Gillette, J L., & Kolpa, R L. (2008). Overview of interstate hydrogen pipeline systems. United States. doi:https://doi.org/10.2172/924391.

[3] W. Li, Y. Zhou, Q. Zhou, J. Li, Analysis of the delayed cracking mechanism of an industrial hot-dip galvanized DP1180GI steel coil, Eng Fail Anal, 160 (2024) 108215