



Experimental and numerical investigation of the gripping force in lined pipe

Ali Kalaki^{1*}, Mehdi Eskandarzade², Farhad Jamilzadeh³, Saeed Barghani⁴

1. Technical and Corrosion Protection Department, Iranian Central Oil Fields Co., Tehran, Iran.
2. Mech. Eng. Group, Faculty of Engineering, University of Mohaghegh Ardabili, Ardabil, Iran.
3. Technical Inspection Department, Iranian Central Oil Fields Co., Tehran, Iran.
4. Manufacturing Department, AzarAb Industries Co., Arak, Iran.

Abstract

Corrosion Resistant Alloys (CRAs) have many applications in oil, gas and petrochemical industries, especially in service fluids contains H₂S and/or CO₂ compounds. The main problem associated with CRAs is that they have not enough strength to withstand the required working pressure, economically. Hence, in high pressure applications, they are used as a thin internal coat inside the cheaper non- CRA pipes. In double wall pipes, if the internal surface are coated by welding process; the manufactured pipe is known as clad pipe which has size and diameter restrictions in production stage; but if a thin corrosion resistant pipe is mechanically bounded to the internal surface of the carbon steel pipe; the produced double wall pipe is known as a lined pipe. Lined pipes in addition to corrosion superiority, have the improved mechanical strength due to the residual pressure between inner and outer pipes. This contact pressure also determines the amount of gripping force at the interface of two pipes. This issue investigated by many researchers; however, there is lack of experimental data to validate the numerical and analytical studies. Therefore, this study focused on experimental measurement of the gripping force in mechanically bounded double wall pipes produced by Thermo Hydraulic Shrink Fit (THSF) process. The measurements showed that the gripping force between outer 4-inch carbon steel and inner 3-inch stainless steel pipes when processing in 350°C and 40 MPa is about 90MPa. This amount of gripping force can be enough for most of applications. In addition to gripping force measurements, cross sections of produced pipe from different sections of the pipe length are cut and visually inspected for the existing of possible defects. The results showed that lamination type defects are likely for this type of production method. Besides, the Finite Element Method (FEM) analysis of the residual contact pressure is conducted. The results are interpreted and discussed.

Key words: Corrosion Resistant Alloys (CRAs), Piping, Oil and gas industry, Thermo Hydraulic Shrink Fit (THSF) process, gripping force.