Martens, M., **Chen, Y. and Liu, M.**, Comparative Integrity Evaluation of Counterbore-Tapered and Back-Beveled Weld Joints, Proceedings of the10th International Pipeline Conference, Calgary, Alberta, Canada, 2014, Paper no. IPC2014-33374

Abstract

Back-beveled transition welds for joining unequal wall thickness are often used in gas and oil transmission pipelines, as recommended in the pipeline codes and standards, such as CSA Z662, ASME B31.8, and ASME 31.4. However, one North American pipeline operator has successively utilized a counterbore-tapered design for transition of unequal wall thicknesses for over 30 years. The design philosophy of the counterbore-tapered joint is to reduce the stress concentrations in the heat affected zone, facilitate the welding of unequal wall thickness and NDT while achieving better quality, reliability, and productivity. By conducting a comparative finite element analysis of the two joint designs, the present study evaluated the pressure containment capacities, the stress concentration factors, the stress intensity factors, and the limit loads of plastic collapses for both the counterbore-tapered and the back-beveled designs. The effect of a key design parameter, the counterbore length, on the integrity of the counterbore design was also examined. The results of the comparative analysis showed that compared to the back-beveled joint, when the pipe materials of unequal wall thickness have the same strength, the counterbore-tapered joint has the same pressure containment capacity as the back-beveled joint. The back-bevel design offers lower stress concentration factor, lower stress intensity factor, and higher limit load of plastic collapse that the back-beveled design.

Keywords

Transition weld, Pipeline integrity, Back-bevel, Counterbore tapered