

Study on Regularities of the Dimensionless Pressure in Bending Pipes

Lu Xiaoyang, Zhang Hao, Lu Xiaoli

Summary

The elbow pipe is the crucial component of the piping system in many engineering fields such as metallurgical industry, material industry, petrochemical industry and chemical industry. Under high temperature and pressure (bulky flux, high velocity of flow) conditions, the non-uniformity of pressure loads has intensified the stress concentration in elbow pipe position. Meanwhile, it occurs obviously in destruction and expiration due to the disfigurement of manufactural technics and partial intensity insufficient. Therefore, the analysis of flow characteristics for elbow and the calculation formula of pressure in elbow are of important theoretical significance and applied value.

After an analytical overview of current domestic and international researches on the fluid flow in elbow, this paper focuses on the flow characteristic in the elbow pipe with circular cross-sections, which are widely used in industrial applications. These flow characteristics have been researched by employing numerical simulation and theoretical analysis. We discussed in detail the influence of a number of non-dimensional parameters such as non-dimensional curvature, Reynolds number, Euler number and non-dimensional axial angle I and circumferential angle I2 on the pressure distribution in elbow pipes. A number of important results have been achieved. The research shows: (1) The non-dimensional pressure decreases with the increase of non-dimensional curvature. (2) The maximum and minimal values of pressure don't change with the parameters. (3) The non-dimensional pressure has nothing to do with Reynolds number. Meanwhile, the considerate and practical calculation formula of pressure is obtained. This paper provides theoretical and numerical methods to understand the mechanical property of fluid flow in elbow pipes, to analyze the stress and to design the wall thickness of elbow pipes.

