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Science Direct

Materials Today: Proceedings 5 (2018) 4551–4562

materialstoday: PROCEEDINGS

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ICMPC 2017

Stress Analysis And Design Optimization Of A Pressure Vessel Using Ansys Package

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Abstract

The pressure vessels are closed containers used to hold gases or liquids at a pressure substantially different from the ambient pressure. The pressure inside the vessel is different and may changes by the conditions. The vessels are too dangerous and fatal accidents have occurred in the history of pressure vessel development and operation. Accordingly vessel design, manufacture, and operation are regulated by engineering authorities backed by legislation.

The main objective of this paper is to design and analysis of pressure vessel. While designing various parameters of Pressure Vessel checked and designed according to the principles specified in American Society of Mechanical Engineers [1] (A.S.M.E) Sec VIII Division 1.

The stress development in the pressure wall critical points are analyzed by using Ansys 15 and an optimized model is modelled to overcome the stresses produced in the vessel. For designing we used Pro-E Creo. Both model parts are [2] designed and analyzed individually with ASME three different materials with the results the best suitable material with good design is developed.

Selection and/or Peer-review under responsibility of 7th International Conference of Materials Processing and Characterization

Keywords: ASME, Ansys, Creo, head, Pressure vessel and shell ;

1. Introduction

Pressure vessels are used to store fluids under pressure. The fluid being stored may undergo a change of state inside the pressure vessel as in case of steam boilers or it may combine with other reagents as in a chemical plant. The pressure vessels are designed with great care because rupture of pressure vessels means an explosion which may cause loss of life and property. The material of pressure vessels may be brittle such that cast iron or ductile such as mild steel. Cylindrical or spherical pressure vessels are commonly used in industry to carry both liquids and gases under pressure. When the pressure vessel is exposed to this pressure, the material comprising the vessel is subjected to pressure loading, and hence stresses, from all directions. The normal stresses resulting

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2214-7853
Selection and/or Peer-review under responsibility of 7th International Conference of Materials Processing and Characterization.

from this pressure are functions of the radius of the element under consideration, the shape of the pressure vessel as well as the applied pressure.

1.1 Amine pressure vessel

Amine gas treating also known as amine scrubbing, gas sweetening and acid gas removal, refers to a group of processes that use aqueous solutions of various alkylamines (commonly referred to simply asamines) to remove hydrogen sulfide (H_2S) and carbon dioxide (CO_2) from gases. It is a common unit process used in refineries, and is also used in petrochemical plants, natural gas processing plants and other industries.

Processes within oil refineries or chemical processing plants that remove hydrogen sulfide are referred to as "sweetening" processes because the odor of the processed products is improved by the absence of hydrogen sulfide. An alternative to the use of amines involves membrane technology. However, membrane separation is less attractive due to the relatively high capital and operating costs as well as other technical factors.

Many different amines are used in gas treating:

- Diethanolamine (DEA)
- Monoethanolamine (MEA)
- Methyldiethanolamine (MDEA)
- Diisopropanolamine (DIPA)
- Aminoethoxyethanol (Diglycolamine) (DGA)

The most commonly used amines in industrial plants are the alkanolamines DEA, MEA, and MDEA shown in figure 1.1. These amines are also used in many oil refineries to remove sour gases from liquid hydrocarbons such as liquified petroleum gas (LPG).

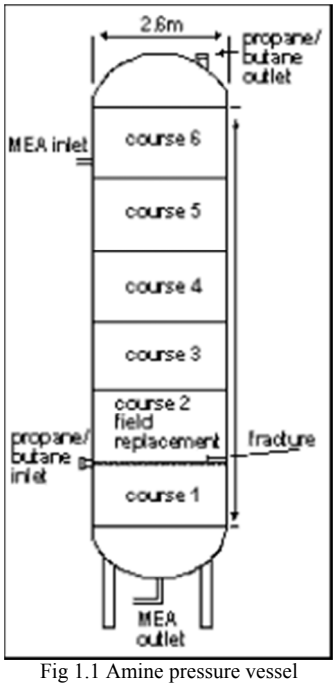

Fig 1.1 Amine pressure vessel

1.2 Component of pressure vessel

There are three main Type are given below

1. Shell
2. Head
3. Nozzle