

Micro Channel Heat Exchanger for LNG-FPSO Application

Seungwhan Baek, Jinhyuck Kim and Sangkwon Jeong
 Cryogenic Engineering Laboratory, Department of Mechanical Engineering, KAIST
 Daejeon, Korea

ABSTRACT

FPSO (Floating Production Storage and Offloading) for LNG industry is a promising efficient method compared to onshore NG (Natural Gas) treatment facility when the well is located in offshore ocean. The heat exchangers in FPSO should be compact and effective due to limited topside area. PCHE (Printed Circuit Heat Exchanger) is considered for application for MCHE (Main Cryogenic Heat Exchanger) in FPSO due to its compactness and high effectiveness. This paper present the idea of utilizing PCHE for LNG-FPSO facility. The design issue of cryogenic PCHE has been discussed and the detailed performance factors of the preliminary designed PCHE have been experimentally examined.

KEY WORDS: FPSO; heat exchanger; microchannel; diffusion bonding; PCHE (Printed Circuit heat exchanger); axial conduction

NOMENCLATURE

A : area
 Ex : exergy
 H : enthalpy
 L : length
 NTU : number of transfer unit
 Q : heat transfer
 R : thermal resistance
 S : entropy
 T : temperature
 U : total heat transfer coefficient
 c_p : specific heat
 h : heat transfer coefficient
 m : mass flow
 ε : effectiveness
 λ : axial conduction

INTRODUCTION

LNG (Liquefied Natural Gas) implies the liquid state of natural gas, which is liquefied at temperature around $-161\text{ }^\circ\text{C}$ (112 K) (Waldmann, Bettina., (2008)). The composition of NG (natural Gas) depends on the well where it is extracted, but most of NG consists of methane (CH_4). LNG has advantages for transportation and energy density. South Korea's LNG demand is currently increasing like the world's LNG demand. LNG was the source of 25% of world energy consumption at 2005, but this demand will be increased up to 50% in next ten years.

Because 20% of natural gas wells are under the sea, the offshore gas plant development is reevaluated as one of the promising energy industries. FPSO (Floating Production Storage & Offloading refines, liquefies and stores natural gas from the sea. This LNG production method has a big advantage in that it does not need to transfer natural gas from offshore place to onshore plant to liquefy it. FPSO can also transport LNG to another ship, which is cost effective. (Fig. 1)

Because many types of equipment must be loaded on the small platform ship in FPSO method, there are some technical constraints for FPSO follows (Barclay and Denton, 2005).

- Lightness of the ship
- Compactness
- Safety

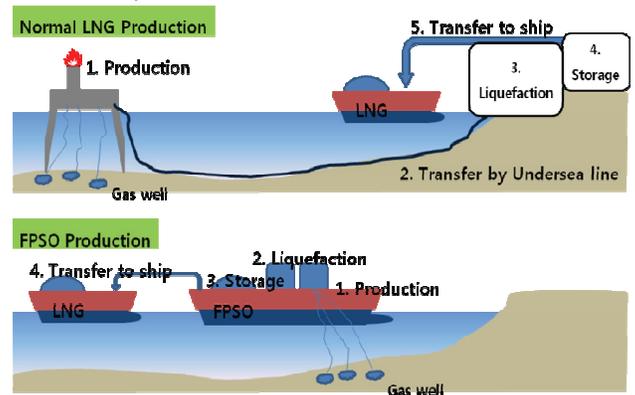


Fig. 1 FPSO method compared to onshore liquefaction process