4. A Study on the Unsteady State Thermal Analysis for the Membrane Type LNG Carrier during Cool-down and Loading Period

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Since LNG Transportation and cargo-handling are done under atmospheric pressure and at the temperature of -162℃, the insulation system of a cargo tank in a LNG carrier performs important roles. These roles include the maintenance of a proper boil off ratio(BOR) and the avoidance of a excessively low temperature in the adjacent hull under the cargo tank.

This study is aimed at the development of a computer program that calculates three-dimensional hull temperature distributions and anlalyzes the BOR which is important for thermal design of the MARK-III membrane type LNG carrier in an unsteady state during cool-down and loading period. A quarter of a cargo tank and a cofferdam are taken as an analysis model. And thermal conductivity of the insulation material, R-PUF is treated as a temperature-dependent property.

In the present study of unsteady state thermal analysis, the temperature of LNG in a cargo

tank is assumed to be -162℃ and air temperature of a cofferdam to be +5℃.

As the results of this study, the temperature distribution and penetrating heat energy of a hull panel and insulation have been predicted at each location during cooling down and loading process. It has been found that the stored heat flux on the top of cargo tank decreases by 4.217 MJ/㎡ before the cool-down, 2.401MJ/㎡ at the completion of the cool-down and 0.164MJ/㎡ at the completion of loading under IMO condition (Tair = 45℃, Tsw=32℃).