Prediction of LNG evaporation and analysis of the wall effect using CFD

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Liquefied Natural Gas (LNG) is stored in a cryogenic condition, which leads to large Boiled Off Gas (BOG) during its transoceanic transport driven primarily by the large temperature differences with ambient conditions. However, the quantification of BOG and analysis of the related phenomena have not been carried out in a satisfactory manner. To quantitively predict BOG and analyze the accompanying phenomena, CFD simulations can be valuable tools. To this end, CFD modeling and simulation of LNG tanks under various transport conditions have been carried out.

In this study, BOG is predicted by multiphase CFD simulations. The intensity of 'sloshing', a periodic movement of the tank due to the waves, is determined by reflecting the weather data and applying the similarity's law. As a result of the simulation, it was found that the boil off phenomenon is more active in regions closer to the tank walls. In addition, the effect of sloshing on BOG is situation-depended.

In addition to the flows inside the tank, the wall temperature profiles have been analyzed with a mesh-based calculation for heat transfer and the results are compared with the linear profile assumption.