

mgr inż. Eliza A. Roszak

Ph.D. Thesis title

Investigation of methane adsorption proces combined with LNG gasification

Supervisor: **prof. dr hab. inż. Maciej Chorowski**

Abstract

The aim of the thesis is to point out the method of utilization of cold exergy of LNG which does not require sophisticated technical construction and can be applied in regions with low technological culture. Filling of Adsorbed Natural Gas tank was chosen as a process possible for coupling with LNG regasification

To calculate amount of physical exergy of gasified LNG which is possible to utilize in LNG-ANG coupling considered system was limited to ANG system filled with carbon materials. Two types of active carbon were selected: special and commercially available.

Experimental apparatus was built to determine parameters of adsorption equilibria. Based on achieved results adsorption isotherms (Tóth and Dubinin-Astakhov models) were determined

Obtained results were used to find right filling pressure of ANG tank filled with investigated carbon materials. Calculation were made for different filling temperature (different level of cooling down the adsorbent) and different packing density of carbon materials. It was shown that it is possible to decrease of filling pressure below atmospheric pressure keeping the same amount of gas stored as in designed conditions.

Dubinin-Astakhov model let to calculate isosteric heat of adsorption for different temperature of adsorption process. These values were used in heat balance of proposed LNG-ANG system and next exergy analysis. Analysis were performed for unit volume of ANG system. It was proved that the best fitted working parameters make it possible to achieve exergy efficiency of LNG-ANG 0,26. It means that 26 % of physical exergy of LNG can be utilized in practical way in LNG-ANG coupling.

In this work comparison of LNG-ANG coupling with LNG regasification system combined with electricity generation systems were done. Possibility of coupling of ANG filling and gasification of other cryogenic liquid (oxygen, nitrogen) was also analyzed.

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Eliza Roszak