Grand Technion Energy Program
תוכנית האנרגיה ע"ש גרנד

Technion Israel Institute of Technology

תכנית האנרגיה ע"ש גרנד מתכבדת להזמינך להרצאה סמינריונית שתינתן ע"י:

מיכאל קוצנקו

התכנית הבין-יחידתית לאנרגיה

בנושא:

Properties of H_2O-N_2-CO_2 at High Pressures and Temperatures for a Nitrogen-Based Alternative Fuel Power Cycle

A Nitrogen based innovative alternative fuel UAN was previously suggested offering an energy storage scheme and an energy carrier solution, in the form of the following reaction 3NH_4 N〖O_3〗_((l))+N_2 H_4 CO_((l))+5.56H_2 O_((l)) →13.56H_2 O+4N_(2_((g)))+C〖O_2〗_((g)). Fuel's Reaction products can be set in the range of 50-250 [bar], and temperature conditions up to 1100 [℃]. These products can serve as the working fluid of a dedicated power cycle offered in this work.

In this thesis a feasible thermodynamic power cycle design is proposed and a suitable mathematical model is offered for the proposed working fluid. The thermodynamic properties of interest are the compressibility factor Z, the saturation conditions 〖P〗_v,T_v, and the specific isobaric heat capacity 〖c〗_p of the working fluid. To provide such data an experimental facility was used in the form of a closed constant volume vessel and a 500 ℃ heater.

The compressibility factor was compared to analytical theoretic EOS methods, and it was found that the EOS (equation of state) of Twu et al, 1995 is the most compatible model at the relevant temperatures range (600-750 [K]). The saturation data was compared with that of pure water and with a second derivative method (Hamming window). It was found that the Second derivative method using the Hamming window is more suitable to predict the saturation conditions with errors below <4%.

A simple case of OCICE (open cycle internal combustion engine) was examined, the HHV efficiency of a simple cycle is predicted to be 49%. Energy output of such a simple OCICE predicted to be W_fuel=2755[J/(gram_AN)] (Joules per gram of AN).

The results of this research will be used for the future design of a dedicated turbine for power production based on the UAN fuel.

מנחים: **פרופ' ישעיהו לוי, הפקולטה להנדסת אוירונוטיקה וחלל**

פרופ' גדעון גרדר, הפקולטה להנדסה כימית

במסגרת עבודת מחקר לתואר מגיסטר

ההרצאה תתקיים ביום ג', 17.1.17, בשעה 14:00, חדר ישיבות, קומה 3, הפקולטה להנדסה כימית

The Nancy and Stephen Grand Technion Energy Program

Technion City, Haifa 32000, Israel
קריית הטכניון, חיפה 32000

Tel: 972-4-8295098
gtep@tx.technion.ac.il
http://gtep.technion.ac.il