Technion-Israel Institute of Technology
Faculty of Mechanical Engineering

Grand Technion Energy Program
תכנית האנרגיה ע"ש גרנד

הטכניון-מכון טכנולוגי לישראל
הפקולטה להנדסת מכונות

סמינריון

הנך מוזמן/ת להרצאה סמינריונית של הפקולטה להנדסת מכונות, שתתקיים ביום ב' 26.03.2018 (י בניסן, תשע"ח), בניין דן קאהן, אודיטוריום 1, 14:30.

מרצה: אנה שוורצפרב

מנחה: פרופ' יהושע דיין

על הנושא:

Developing two-chamber reactor for gasification of biomass, organic waste and poor fossil fuels

The seminar will be given in Hebrew

תקציר ההרצאה :

The research proposes developing a two-chamber reactor for gasification of biomass and low-grade fossil fuels (oil shale, bitumen, etc.) along with reducing environment pollution, e. g., utilizing and removing agricultural and industrial refuse and enhancing poor fossil resources, which are abandoned and constitute hazardous environmental contaminates. The composition of the obtained product syngas will determine its optimal conversion into liquid transportation fuels, petrochemical feedstock, or fuel to gas turbines and fuel-cell systems (electric generator.)

In most gasification methods, small part of the raw feed is burnt to supply the necessary heat for the endothermic gasification reactions. Unlike the existing commercial processes in which cryogenic air separation is used to extract oxygen for the burning and avoid syngas dilution by the nitrogen, most of the recent development approaches use solid particles circulation for beat transfer between two reactors. In the first, residual fuel, mixed with the solid particles is burned by air in fast fluidized bed. The hot particles are transferred to the second reactor, in which the endothermic gasification occurs (typically feed and steam) utilizing the particles heat by direct contact in slow fluidized bed. The cooled particles, and unreacted feed are circulated back to the combustor. The proposed process features some superior modifications: it is based on a single rectangular reactor divided into two chambers (2CG). The gasification of the feed, mixed with the hot particles and steam, occurs in a downwards moving packed bed regime (rather than fluidization). The residual unreacted organics mixed with the cooled particles enter at the bottom from the gasification chamber into the combustion chamber, burnt with air in fast fluidized bed regime, which carries the reheated particles to the top. The hot particles are spilled over, back into the gasifier, through a cyclone, which blocks flue gases penetration. The two different flow regimes ensure leaks blockage and the rectangular configuration offers easy scale-up for future commercialization

The main purpose of this research is to prove and demonstrate the feasibility of the 2CG concept. Two-chamber reactor was designed and built. In addition, a theoretical base for studying and understanding the flows and heat-transfer mechanism was developed. The effects of the process parameters: feed (type composition and size), temperature, circulation rate, size and abrasion of the heat transferring solid particles, on product composition and its purity, production and amount of tar as well as overall behavior, controllability and stability is been studied. The obtained information will enable to determine the best usage of the syngas, building suitable control system, efficient operation and maintenance policy for the process, optimal design and scale-up. The catalyst will be capable of enhancing hydrogen production. Further studies of catalysts effects on faster and higher yield at lower temperatures and on syngas composition is studied by coworkers at Technion Chemistry Department.

בברכה,

פרופ"א מתי סאס
מרכז הסמינרים