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|  |  |  הטכניון - מכון טכנולוגי לישראל TECHNION - ISRAEL INSTITUTE OF TECHNOLOGY  |
| הפקולטה להנדסה כימיתע"ש וולפסון |  |  |
| The Wolfson Department of Chemical Engineering |  |  |

**Wolfson Department of Chemical Engineering Seminar**

**Monday, August 5th, 2024 at 14:00**

**Zoom:** https://technion.zoom.us/j/96298325147

 **Experimental investigation and multi-scale simulation verification of biomass fast pyrolysis and oxidative pyrolysis**

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**MSc Seminar**

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Biomass is a sustainable energy source and can be easily obtained from agricultural residues, forest wastes, municipal wastes, microalgae, and so on. Fast pyrolysis is an efficient way to convert it into high-value fuels and more. The understanding of complex fluidization hydrodynamics and chemical reactions in biomass fast pyrolysis fluidized bed reactors is lacking and requires further investigation. It is urgent to develop accurate mathematical models that can describe the complex multiphase reaction system of biomass pyrolysis and corresponding experimental verification.

In first work, a comprehensive multi-scale model based on coarse-grained discrete element method (DEM)-computational fluid dynamics (CFD) was developed in open-source MFiX code. It incorporates detailed biomass pyrolysis kinetics and an intraparticle model. To validate the model, measurements were conducted in a fluidized bed pyrolyzer, including quantifying the segmental pressure drop along the height of the bed and determining the yields and compositions of gas, liquid, and solid products. The study provides experimental and theoretical foundations for designing multiphase fluidized bed reactors and advancing biomass thermochemical conversion.

In second work, experiments were conducted in a fluidized bed reactor to study the oxidative fast pyrolysis of biomass, measuring pressure drops and analyzing the yields and compositions of the products at varying oxygen concentrations. Increasing oxygen led to higher biogas yields but reduced bio-oil and biochar outputs, with a notable decrease in tar content in the bio-oil. A multiscale model was developed using the MFiX code, incorporating DEM-CFD reactor modeling and biomass pyrolysis kinetics, which was validated against experimental data. This work provides a foundational basis for optimizing and scaling up the process in fluidized beds.