|  |  |  |
| --- | --- | --- |
|  |  |  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**

**Wednesday, February 02, 2022 at 13:30**

 **Via Zoom:** <https://technion.zoom.us/j/97577956516>

**Fuel Reforming in Internal Combustion Engines**

**Assoc. Prof. Leonid Tartakovsky**

Faculty of Mechanical Engineering, Technion-Israel Institute for Technology

The climate change, security of energy supply and air pollution challenges require development of new propulsion concepts that would enable meeting CO2-neutral economy and zero-impact emission requirements. We believe that internal combustion engines (ICEs) fed by electrofuels are able to meet these challenges most successfully. For this purpose, efficient waste heat recovery and combustion methods should be developed. The engine waste heat can be used to sustain endothermic reactions of fuel reforming.

A novel fuel reforming concept of High-Pressure Thermochemical Recuperation (HP-TCR) was developed and successfully studied in the Technion. It enables dramatic improvement in energy efficiency by 20%-30% and reduction of gaseous pollutant emissions to zero-impact levels without any need in exhaust gas aftertreatment. A first ever laboratory prototype of an ICE with HP-TCR was built and investigated. At the same time, the experiments showed that non-premixed hydrogen combustion leads to increase in particle formation due to enhanced lubricant involvement in the combustion process. In-depth investigation of this phenomenon allowed us to describe a mechanism of particles formation in H2 combustion. The latter achievement paves a way to development of particle mitigation methods. An additional challenge is the need in a compact and efficient catalytic reactor. A honeycomb monolith reactor with CuO/ZnO catalyst coating could be a possible solution. Such a reformer was designed and manufactured using 3D printing technology.

The developed HP-TCR concept can be successfully integrated with low-temperature combustion or/and a fuel cell with subsequent additional benefits in terms of efficiency and emissions. For example, combining ICE, HP-TCR and a solid-oxide fuel cell allows achieving unprecedent efficiency levels above 70% at attractive power densities.