Ben-Gurion University of the Negev
אוניברסיטת בן-גוריון בנגב

Graduate Students Seminar

Department of Chemistry

Sunday April 11, 2021

Time 16:30

ZOOM

https://us02web.zoom.us/j/82774348876?pwd=cGd6S2pHWDJMSmx3NUtKVWNMS01vZz09

Meeting ID: 827 7434 8876
Passcode: 840818

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Investigating decomposition mechanisms in cold plasma with *in situ* optical diagnostics

Solid plastic waste is a major global issue and decomposing it poses many environmental challenges. Until now many treatment methods have been tried but none of them offer a full solution for both avoiding harmful byproducts and achieving energy efficiency. We investigate here the chemistry behind a new technique that can decompose plastics in an efficient and environmentally friendly manner by relying on the unusual properties of "cold" plasmas; more familiar "hot" plasma conditions allow frequent collisions and lead to thermalized chemical mechanisms, while cold or low-pressure plasmas undergo fewer collisions and therefore more efficiently channel the input energy into radical-based chemical mechanisms, without nearly as much heating. In our study, the different species formed inside the complex, non-equilibrium situation created by a cold plasma reactor are observed by *in situ* optical emission spectroscopy (OES) instruments. Recently we have added on-line sampling mass spectrometry by a residual gas analyzer (RGA) that provides complementary information about the product species, especially those with unobservable or overlapping emission spectra. Analysis of the data yields information about the different species and their energy transitions, temperature and pressure and involves spectral simulations and plasma modeling. These computational analysis methods also guide experimental planning as we explore cold plasma chemical mechanisms. In order to eventually treat plastics polymers, such as HDPE and PP, we are starting

initially with simple (hydrocarbon) systems (alkanes, alcohols) to catalog their characteristic plasma emission spectra, and subsequently their reactive intermediates and decomposition mechanisms. One of the simplest such cases (water splitting to form hydrogen) is of considerable fundamental and applied interest and will be discussed as an example.