PROCESSING OF HYDROCARBONS DRIVEN BY ELECTRON BEAM AND NON-THERMAL PLASMAS

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Abstract: Energetic processing of liquid and gas phase hydrocarbons as Crude Oil, Methane (CH_4) and Acetylene (C_2H_2) driven by Electron-Beam plasma, as well as other nonthermal plasma generation techniques as Radio Frequency (RF) discharges, Direct Current (DC) discharges, and Hybrid Plasma (HP) discharges has been studied in plasmachemical reactor in conditions of low temperatures and low pressures. Experimental results show the cracking of long molecules and polymerization of shorter ones using different plasma modes. Analysis of Plasma has been performed using mass spectroscopy, fiber optic spectrometry, Charge-coupled Device (CCD) Camera imaging as well as electric diagnostics techniques as Langmuir probes.

To improve understanding of reaction mechanism and pathway of plasma process Monte Carlo based modeling of plasma has been performed. Effects of plasma processing over liquid phase hydrocarbons was studied using Fourier Transform Infrared (FTIR) spectroscopy analysis as well as contact angle and viscosity measurement. The results obtained show Electron-Beam and hybrid plasma discharges produces cracking, reducing the size of chain of hydrocarbon molecules and RF Plasma discharges induces polymerization, generating longer molecular chains. The achieved results prove the cracking and polymerization process to be considered as promising applications of nonthermal plasma processing of hydrocarbons for environmental, energy, nanomaterial and industrial applications as well as for reproduce in laboratory astrochemical reactions involving Polycyclic Aromatic Hydrocarbons (PAH) present in Low Earth Orbit (LEO).

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