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Gas Composition Changes in Heavy Oil Conversion by Submerged Multi-Phase Pulsed Plasmas[1] SHARIFUL ISLAM BHUIYAN, KUNG-PENG WANG, ABDULLAH HILL BAKY, CHRISTOPHER CAMPBELL, DAVID STAACK, Department of Mechanical Engineering, Texas A&M University, College Station, HOWARD JEMISON, LTEOil LLC — In this study we investigated the changes in gas phase composition that occurs under submerged multi-phase pulsed plasmas in hydrocarbons. Discharges were generated under mineral oil along with initial processing gas flow of methane. The spark gap was submerged under liquid and electrical breakdown happens as high voltage is applied. The discharge is characterized by nanosecond pulse duration and low energy per pulse. These high frequency high voltage pulses generate low temperature atmospheric pressure non-equilibrium plasma that interact with the surrounding liquids and vapors by cracking and reforming the hydrocarbon molecules. A closed system was developed with recirculating gas flow. Gas chromatography was used to analyze the processing gas. Preliminary results show methane mole concentration decreases to 50% while hydrogen concentration increases to 40% and there is a 15% pressure rise in the system. Other compounds formed by plasma chemistry include formation of acetylene, ethane, ethylene, propane, propylene, butane and pentane in small percentages. However, the overall mass of the gases decreases and stoichiometric analysis show absorption of CH radicals into liquid. These results indicate gas to liquid conversion with plasma treatment in oil.

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