MECHANISMS OF NON-EQUILIBRIUM DISSOCIATION OF HYDROGEN SULFIDE IN LOW-TEMPERATURE PLASMA

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Hydrogen sulfide (H_2S) is a byproduct of oil refinement and comprises a significant portion of natural gas deposits. Therefore, efficient H_2S treatment and utilization are crucial to the oil and gas industry. The minimum dissociation energy of H_2S (into hydrogen and sulfur) is only 0.2 eV/molecule. Such low energy requirement of dissociation of H_2S into sulfur and hydrogen is important commercially. Such prospects are particularly important for oil industry, which consumes large amounts of hydrogen in oil hydro-desulfurization for production of low sulfur fuels and could benefit from both low cost method of H_2S utilization and local hydrogen production.

The process of hydrogen sulfide, dissociation was studied in a non-equilibrium pulsed discharges at high and moderate overvoltage. Discharge geometry allowed to switch from streamer to spark mode. Separate series of experiments were conducted for dielectric barrier discharge geometry. An energy cost of H_2S dissociation was measured at low pressure conditions. Comparison of these results with recent results from gliding arc ‘‘tornado’’ (GAT)[1] discharges allows to extract basic mechanisms which control H2S dissociation in the discharge.

These results are particularly important for the oil industry as it considered economically feasible to industrially implement dissociation technology that has energy requirement of undter 1 eV/molecule. These findings allow for further development, optimization, and scaling of reactors based on direct plasma dissociation of hydrogen sulfide.

1. Nunnally, T., K. Gutsol, et al. (2009). "Dissociation of H2S in non-equilibrium gliding arc 'tornado' discharge." International Journal of Hydrogen Energy **34**(18): 7618-7625.