Effects of Contaminants on Acid Gas Pyrolysis

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This research project studied the effects of various contaminants on the products of H2S pyrolysis. The study was conducted at the University of Maryland Combustion Laboratory and examined products of the reaction with variable inlet gas compositions over a wide range of temperatures to determine the effects of the contaminants on the reaction. Examined contaminants included benzene, xylene and superheated steam/carbon dioxide mixture. Benzene was examined at 0.8% molar concentration with 90% N2 dilution across a temperature range of 1000C - 1400C. Xylene was examined at 0.6% molar concentration with 90% N2 dilution across a temperature range of 1000C - 1400C. Superheated steam in the presence of 40%/60% acid gas was examined between 0% - 20% molar concentrations at 1200C. Results indicated that aromatic contaminants tended to increase H2 production and H2S conversion while simultaneously producing carbon disulfide (CS2). Sulfur deposits were significantly contaminated with carbon. H2 production and H2S conversion followed a similar positive quadratic trend as thermodynamic simulations, but measured values were significantly greater than expected. CS2 production against temperature followed a strongly positive trend, opposite of the weakly negative trend expected by simulations. Superheated steam in acid gas slightly increased H2 and CO production, but decreased inlet gas conversion. However, measured results, although quadratic, did not closely match thermodynamic simulations possibly due to unexpected radical auto-acceleration. Experiments should be retested with longer residence times and more accurate inlet flow controllers to confirm these findings.