O30

Furnace coking simulations in a laboratory apparatus

Paul Eaton[a,*], Bruce Newman[b], Murray Gray[c], Alan Kubis[c], Marzie Derakhshesh[c], Chris Holt[c], David Mitlin[c]

[a] *Champion Technologies Inc., Houston, TX, paul.eaton@champ-tech.com*
[b] *ConocoPhillips, Bartlesville, OK, Bruce.A.Newman@conocophillips.com*
[c] *Department of Chemical and Materials Engineering, University of Alberta, Canada*
(corresponding author paul.eaton@champ-tech.com)*

Fouling tests were conducted on the atmospheric bottoms (ATB) of a crude oil to simulate fouling in a delayed coker furnace. Foulant was deposited on a hot wire fouling probe exposed to a heated, moving fluid in a strirred batch reactor. System fouling factor was determined from standard heat transfer theory and recorded vs. time as an in-situ indicator of fouling intensity. Post-test examination of deposit thickness and composition was completed using extractive-iron-nickel ion chromatography, optical and scanning electron microscopy (SEM), and electron dispersion spectroscopy (EDS). A focused-ion beam (FIB) was used to prepare cross sections through the deposit and the surface of the wire in order to examine not only the microstructure of the coke, but also the changes in the surface layers of the metal during coke deposition. Primary test variables studied in the present work were surface metallurgy, feed composition, and wire temperature.

Three metals were used for the fouling probe surface, 304 stainless steel, iron, and mild steel. The iron probe fouled more than the stainless steel probe at 200 F lower surface temperature, whereas the mild steel wire fouled at a level between the iron and stainless steel wires. The composition of feedstock was changed by diluting the atmospheric tower bottoms (ATB) with heavy paraffin oil. The diluted ATB was observed to foul greater than undiluted ATB. Possible reasons for the increased fouling rates for surface and bulk changes are presented with suggestions for further research.