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NO: WANL-TMI-1522

From: I. E. Kanter, Reactor Analysis

Date: August 20, 1965

Subject: Comparison of WANL Corrosion Data with ICAP: HHT-6.2-1, Short Slit.

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In order to test the relationships used for reactor corrosion predictions an attempt was made to compare these calculations with the data obtained on a laboratory corrosion experiment.

One corrosion test was run on a short slit using HHT-6 hardware. The slit was machined from a split cylinder of unfueled graphite, grade HLM85, and was 6 mils thick, 2 inches long and 1 inch wide. Test conditions, given in Table I, were approximately 3500 °R, 223 psia, and 1×10^{-4} pounds of hydrogen per second. The post-operation data on surface regression are plotted in Figure 1. Note that depth and width is that of the corroded surface (explaining the narrow width at slit exit). The set of traces include each side of the slit.

For a comparison, the ICAP code was run using the geometry of developed flow between plane parallel plates. The input conditions used were a constant pressure of 223 psia, an axial material temperature of 3520 to 3534 °R (at exit), and a hydrogen flow

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of 9.325×10^{-5} lbs/sec with a total test duration of 30 min. The program assumes that the local bulk fluid temperature is similar to the material surface temperature and therefore provides only a first approximation to the solution of the problem. Along with these conditions, the kinetics were parameterized to show the effect of order of reaction. (Order of reaction and attendant reaction velocity constant were changed in a consistent manner). Kinetic parameters used are those currently being utilized for unfueled reactor components (eq. Data Book G.3.b.3. 1 & 2 and G.4.b.3. 1 & 2).

The results of these calculations are presented in Figure 2 along with the average measurements taken from Figure 1. It appears, for the most part, that the current kinetic system using an order of reaction of 1 and 1/3 for the methane and acetylene reactions, respectively, predict reasonable values. The next best combination seemingly 1 and 0. It should be noted that these data are for a lower pressure range than the reactor environment and therefore the effect of pressure level on rate of reaction has yet to be ascertained. For this reason, it is advised that such tests as these be continued with a range of variables fully capable of covering the field of interest.

For a final comparison, the measured weight loss of 2.36 gms is greater than the calculated value of 1.81 gms for the case of (1, 1/3) orders of reaction.

I. E. Kanter

DATA* For HHT-6.2 Corrosion Tests

$P_{bar} = 29.34" Hg @ 75^{\circ} F$

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Point Number	Time Min.	Rig DP Psid	Gas Inlet Temp °F	Gas Exit Temp °F	M/L Inlet Temp °F	M/L Exit Temp °F	Flow STD cc/min H ₂	Inlet Pressure Psig
1	0	5.01	88.1	1504	3084	3100	28,750	210
2	4	3.6	88.1	1540	3060	3080	27,750	212
3	8	3.65	88.0	1470	3056	3078	28,000	210
4	12	2.65	88.5	1511	3053	3074	28,000	208
5	16	2.42	89.0	1525	3053	3078	28,000	206
6	20	2.2	89.0	1532	3060	3074	28,000	208
7	24	2.1	89.0	1500	3048	3067	28,000	208
8	28	2.05	89.0	1500	3074	3084	28,000	208
<p>Initial gap = .006 inches Gap increase at inlet = .0418 inches Gap increase at Exit = .0043 inches Total wt. loss = 2.363 gms.</p>								
<p>* PRELIMINARY DATA OBTAINED FROM FLUID FLOW LABORATORY.</p>								

SINGLE SLIT CORROSION TEST HHT-6.2-1 * SURFACE REGRESSION

(6 MIL GAP)

FIGURE 1

* DATA FROM R. STEFFEN

SURFACE REGRESSION RESULTS
 HHT-6.2-1 ; 6 MIL GAP
 COMPARISON
 OF
 EXPERIMENTAL RESULTS
 WITH
 ICAP PROGRAM
 FIGURE 2