Chem. Engr. 06-607 Physical Chemistry of Colloids and Surfaces

Homework #4   **2-21-02**

Due: 3-5-02, beginning of class.

1. Problem 5, Hiemenz handout.

2. Problem 6, Hiemenz handout.

3. Problem 1.1, Evans.

4. Problem 1.2, Evans.

5. Problem 3.11, Evans.

4. Examine the temperature variation of K values from the preceding problem by means of the procedure given in Example 9.3. (To decrease computational effort, various members of the class may be assigned different temperatures to analyze in Problem 3. The K values may then be pooled for this problem.)

5. The accompanying data* give the volume of N_2 at STP adsorbed on colloidal silica at the temperature of liquid nitrogen as a function of the ratio p/p_0. Plot these results according to the linear form of the BET equation. Evaluate c, V_m, and A_{sp} from these results, using 16.2 $\mathring{A}^2$ as the value for σ^0.

V at STP (cm^3 g^{-1})	p/p_0	V at STP (cm^3 g^{-1})	p/p_0
44	0.008	117	0.558
52	0.025	122	0.592
57	0.034	130	0.633
61	0.067	148	0.692
64	0.075	165	0.733
65	0.083	194	0.775
70	0.142	204	0.792
77	0.183	248	0.825
78	0.208	296	0.850
85	0.275		
90	0.333		
96	0.375		
100	0.425		
109	0.505		

6. The following data give the volume at STP of nitrogen and argon adsorbed on the same nonporous silica at $-196\,°C$:†

	V at STP (cm^3 g^{-1})	
p/p_0	Nitrogen	Argon
0.05	34	23
0.10	38	29
0.15	43	32
0.20	46	38
0.25	48	41
0.30	51	43
0.35	54	45
0.40	58	50
0.45	58	54
0.50	61	55
0.60	68	62
0.70	77	69
0.80	89	79
0.90	118	93

Using 16.2 $\mathring{A}^2$ as the N_2 cross section, calculate A_{sp} for the silica by the BET method. What value of σ^0 is required to give the same BET area for the argon data?

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*Everett, D. H., Parfitt, G. D., Sing, K. S. W., and Wilson, R., *J. Appl. Chem. Biotechnol.*, **24**, 199 (1974).

†Payne, D. A., Sing, K. S. W., and Turk, D. H., *J. Colloid Interface Sci.*, **43**, 287 (1973).