

LETTERS TO THE EDITOR

Adsorption of Hydrogen Sulfide on Microporous Carbon

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Information on the interaction of H₂S with surfaces, including carbon, is of increasing importance as interest grows on its removal from gaseous streams. For example, a carbon surface is an active catalyst for the oxidation of H₂S to elemental sulfur [1].

In this study, the uptake of H₂S on Saran carbon was measured between 60–175°. The microporous carbon was produced by the carbonization at 900° of Saran 489, supplied by the Dow Chemical Company. From adsorption of CO₂ at 25° and using a Dubinin plot [2], a micropore surface area of 932 m²/g is calculated for a 65 × 150 mesh particle size fraction of this carbon [3]. For this calculation, a molecular area for CO₂ at 25° of 25.3 Å² was taken [4].

Adsorption of H₂S was measured gravimetrically using a Cahn R. G. electrobalance, having a total capacity of 2.5 g and a sensitivity of 0.1 μg. The microbalance, housed in a glass vacuum bottle, was connected to a mercury diffusion-mechanical pump combination in order to attain a running vacuum of 10⁻⁵ Torr. Prior to an adsorption run, the carbon was outgassed at 900° for 1 hr. For adsorption isotherms, 30 min was allowed for each adsorption point.

Figure 1 presents isotherm data for adsorption at 60, 100, 140, and 175°. Duplicability of results was good following degassing of the sample at 900° between runs. Clausius-Clapeyron plots of $\ln(p)$ VS $1/T$ at fixed values of coverage (2, 3, 5, and 7 cm³ H₂S/g of carbon) were good straight lines of equal slope, giving an isosteric heat of adsorption of 5.8 kcal/mole. For comparison, the heat of condensation of H₂S is about 4.0 kcal/mole [5].

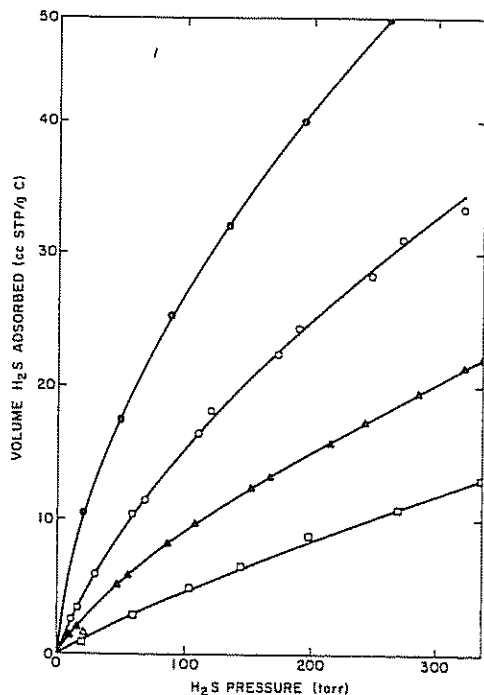


Fig. 1. Isotherms for adsorption of H₂S on Saran carbon at ●, 60°; ○, 100°; ▲, 140°; □, 175°.

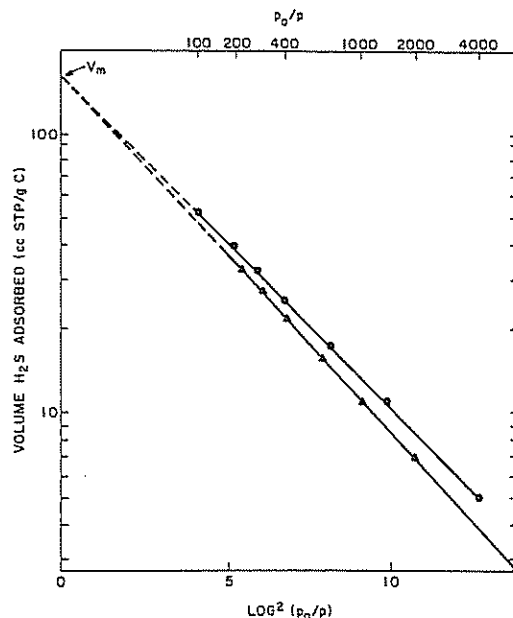


Fig. 2. Dubinin plots for H₂S adsorption on Saran carbon over the pressure range 9–350 Torr and temperatures of ●, 60° and ▲, 100°.

Micropore surface areas can be estimated from H₂S adsorption isotherms measured at and below the critical temperature of H₂S (100.5°C) using the Dubinin-Polanyi potential energy equation [2]. Figure 2 shows Dubinin plots of $\log^2(p_0/p)$ vs $\log V$ for adsorption at 60 and 100°. Values for p_0 were taken as 44.5 and 88.7 atm at 60 and 100°, respectively. The volume of H₂S held in the micropores is estimated by the linear extrapolation of the plots to the ordinate at $\log^2(p_0/p)$ equal to zero. If the micropore surface area of the carbon was 932 m²/g based on CO₂ adsorption at 25°, the area of a molecule of H₂S adsorbed between 60–100° would need be 21.5 Å² to satisfy a V_m value of 160 cm³ (STP)/g. No previous molecular area data for H₂S adsorbed at these temperatures on carbon have been available, to the authors' knowledge. Harris and Emmett report the coverage of H₂S to be 21 Å² on surfaces of glass spheres, iron catalysts, and silver [6].

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