
Application of Inverse Gas Chromatography to the Study of the Surface Properties of Slates

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Abstract: Inverse gas chromatography (IGC) at zero surface coverage was used for determining the surface characteristics of a slate sample. Previously this sample had been characterized by means of X-ray diffraction (XRD), chemical analysis, infrared (IR) spectroscopy and nitrogen adsorption. Quartz, muscovite and chlorite were the minerals forming the slate. A well-defined mesoporous structure with pores of 15 Å of interlayer distance was observed. Chemical analysis and IR spectroscopy corroborated the X-ray results. The surface characteristics of the slate were defined in relation to nonspecific and specific interactions with organic molecules. In accordance with the nonspecific interactions, the London component (γ_S^D) of the surface free energy gave an estimation of the surface energy of the slate sample. The obtained values for γ_S^D were 140.0, 124.8, 108.2 and 96.8 mN m⁻¹ at 100, 110, 120 and 130 ° C, respectively. These values were characteristic of an inorganic sample of high surface energy. The values of the thermodynamic variables—differential heat of adsorption, free energy and entropy of adsorption—were in accordance with these results. At the same time, specific interactions were characterized by the ϵ_π parameter and the acid-base (K_A , K_B) indices. The positive value of ϵ_π (0.09 kJ mol⁻¹) indicated the presence of Lewis acidic sites on the slate surface. The value of K_A (acid index) of 1.17 was higher than the value of K_B (base index) of 0.37; this result confirmed the acidic nature of the studied slate's surface.

Key Words: Inverse Gas Chromatography • Slate • Surface

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