
The Problem of Expressing the Specific Surface Areas of Clay Fractions

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Abstract: Estimations of the external specific surface areas (S.S.A.) by the N₂-BET method of clay separates that were further fractionated by the high gradient magnetic separation technique revealed that the magnetic fractions had consistently lower S.S.A. compared to non-magnetic fractions. This phenomenon has been attributed, in the past, to the intimate association of Fe-oxides with silicate clays. It is the contention of this study that this reasoning is insufficient due to the following reasons. X-ray diffractograms (XRD) confirmed that heavy minerals were abundant in the magnetic fractions of these clays. Total chemical analyses and energy dispersive X-ray analyses showed that these heavy minerals contained Fe and Ti, which were not completely extracted by the dithionite-citrate bicarbonate (DCB) treatments. Crystallinity and quantity of these oxides in the different fractions did not show any relationships with the S.S.A. Lower S.S.A. were found in the magnetic fractions of both coarse and fine clays in the untreated as well as DCB-treated samples. The average particle density of the magnetic fractions was found to be higher than the non-magnetic fractions, resulting in an underestimation of the S.S.A. This underestimation was further proven when clay-sized illmenite (density = 4.79 Mg m⁻³) was found to have lower S.S.A. than quartz (density = 2.65 Mg m⁻³) and well-crystallized Georgia kaolinite (density = 2.61 Mg m⁻³), even though the illmenite particles were smaller in size compared to the kaolinite particles and similar in size compared to the quartz particles. It is, therefore, proposed that the specific surface areas should be expressed either on a volumetric basis or corrected for differences in density to avoid underestimations when heavy minerals are present in the samples.

Key Words: Density • Fe and Ti oxides • Magnetic and non-magnetic fractions • Specific surface area

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