# Sate and Location of Water Adsorbed on Clay Minerals: Consequences of the Hydration and Swelling-Shrinkage Phenomena

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**Abstract:** The application of the Frenkel-Halsey-Hill (FHH) formalism to the water desorption isotherms obtained for the whole range of the activity of water with the pressure membrane device ($0.98 < a_w < 1$) and with the desiccator ($0 < a_w < 0.98$) gives information concerning the nature and the relative importance of the 2 mechanisms involved in the dehydration-hydration processes: adsorption and capillary condensation. The state and location of water are described in each domain. An equation that gives the thickness $t$ of the film of water adsorbed on the walls of pores versus the activity of water is developed. This $t$-curve is used to get, from the desorption isotherm, the pore size distribution curve of the studied hydrated materials. Then concepts of surface and fabric of clay pastes are discussed as a function of hydration and a mechanism is proposed to explain swelling and shrinkage of finely divided materials.Three kinds of surfaces, related to the aggregate fabric, are defined as a function of their capacity to adsorb water. Each kind of surface is determined by a specific technique: the total surface area ($S_t$) by ethylene glycol adsorption, the external surface area of particles ($S_s$) by nitrogen adsorption and the external surface area of aggregates ($S_e$) by hydraulic conductivity measurements. As a consequence it is only with completely dispersed clays that swelling is a function of $S_t$. With unwell-dispersed clays, water adsorption, which induces swelling, successively occurs on $S_t$, $S_s$ and $S_e$ surfaces.

**Key Words:** Clay Paste Fabric • Hydration • State and Location of Water • Swelling and Shrinkage Mechanisms • $t$-Curve

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