The Hydrophilicity and Hydrophobicity of Clay Minerals

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Abstract: The terms "hydrophobic" and "hydrophilic" are typically used in a non-specific sense and, as such, they have a limited utility. Surface thermodynamic theory, as described here, allows a natural and potentially powerful definition of these terms. The boundary between hydrophobicity and hydrophilicity occurs when the difference between the apolar attraction and the polar repulsion between molecules or particles of material (1) immersed in water (w) is equal to the cohesive polar attraction between the water molecules. Under these conditions, the interfacial free energy of interaction between particles of 1, immersed in water (ignoring electrostatic interactions), ΔG 1w1 IF exactly zero. When ΔG 1w1 IF is positive, the interaction of the material with water dominates and the surface of the material is hydrophilic; when ΔG 1w1 IF is negative, the polar cohesive attraction between the water molecules dominates and the material is hydrophobic. Thus, the sign of defines the nature of the surface and the magnitude of may be used as the natural quantitative measure of the surface hydrophobicity or hydrophilicity.

Key Words: Hydrophilic • Hydrophobic • Surface thermodynamics