

Water adsorption on a clay mineral as studied by IR micro-spectroscopy with a humidity control system

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New Method for studying adsorption behavior

Clay minerals in the atmosphere are considered to adsorb atmospheric pollutants such as SO_x, NO_x and volatile organic carbons. Their adsorption behavior is reported to be affected by relative humidity (RH). In this study, adsorption behavior of water on a Na-montmorillonite has been studied by infrared (IR) micro-spectroscopy combined with quartz crystal microbalance (QCM) and a RH control system (Fig 1).

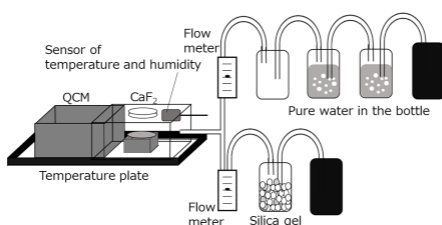


Fig 1: An in-situ observation cell for IR micro-spectroscopy with QCM and a RH control system.

Results: water adsorption to montmorillonite

With increasing relative humidity (RH) at room temperature ($24.5 \pm 0.2^\circ\text{C}$), while band area of X-OH (X=Si,Al,Na) stretching (around 3600cm^{-1}) remains unchanged, OH band areas of longer (around 3400cm^{-1}) and shorter (around 3250cm^{-1}) H bonded water increase. They were converted to weights by using QCM data and molar absorption coefficients (Fig.2).

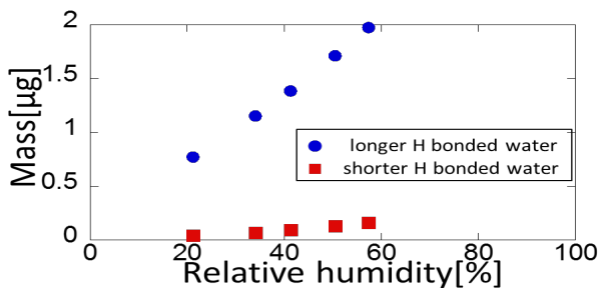


Fig 2: The amount (μg) of longer and shorter H bonded water in Na-montmorillonite as a function of relative humidity (RH).