Interactions of water and minerals/organics as studied by infrared micro-spectroscopy combined with quartz crystal microbalance under controlled relative humidity

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In Earth's surface environments, interactions among water, minerals and organics control divers geochemical processes. In order to study adsorption of water on surfaces of minerals and organics, we have developed infrared (IR) micro-spectroscopy under controlled relative humidity combined with quartz crystal microbalance (QCM)(Fig.1).

Water molecules adsorbed on a Na-montmorillonite clay film and a collagen film with increasing RH at different temperatures were first studied by QCM to determine total water weights adsorbed. Then, IR spectra were used to analyze different water species in OH streching and bending bands: bound water with shorter H bonds and free water with longer H bonds.

This method can be extended to study adsorption of hydrophylic, hydrophobic and amphipathic compounds on minerals and organics under controled relative humidity at various temperatures. Adsorption sites for these compounds and their competition with water molecules can also be investigated.

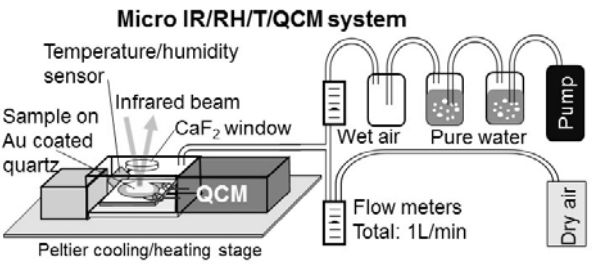

Fig.1. Infrared (IR) micro-spectroscopy combined with a quartz crystal microbalance (QCM) together with a relative humidity (RH) and temperature control system.