A FLOW-THROUGH REACTION CELL FOR THE IN-SITU MONITORING OF MINERAL REACTIONS IN SOLUTION BY POWDER X-RAY DIFFRACTION

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A flow-through reaction cell is presented which allows in-situ measurement of mineral powder-solution mixtures by powder X-ray diffraction techniques without sample preparation or major disturbance of the sample system. The set-up allows both closed static and open percolating systems to be investigated. The cell is the size of a normal powder holder and is made from a PTFE (Teflon) compound containing 25% carbon. Teflon hoses attached to both sides of the cell allow solutions to percolate through the powder mineral sample during or between measurements. The upper window of the cell is sealed with Kapton foil, allowing in-situ measurement of the sample material. Monitoring changes in crystalline reactants and products during time dependent experiments can be used to determine reaction mechanisms and to quantify the rates of both crystal dissolution and crystal growth. As a demonstration, we present results from the anhydrite to gypsum hydration reaction at room temperature. The cell can also be sealed with a pressure resistant lid and placed in an oven to attain hydrothermal conditions. This device allows the kinetics of reactions to be determined directly from changes in mineral concentrations in the cell, as reflected by systematic changes in the intensities of X-ray diffraction peaks. Such results can be compared with changes in the composition of the percolating solution, which can be easily sampled during the experiment.