Apparent dielectric constants of brines estimated from quartz solubilities

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The dielectric constant is a key parameter characterizing chemical properties of solvents. Geofluids are coceived commonly as mixutes of water, salt and gas species. The constant of a mixture of water and gas can be calculated by following Akinfiev and Zotov [1], while there may be no reliable equation to obtain that of water and salt.

We have reinvestigated about 300 data for quartz solubilities in brines of various salinities in previous experiments at a wide range of P-T conditions to estimate "apparent" dielectric constants of brines. The obtained constants were inter- or extrapolated for 1 molal NaCl solutions. The resultant constants for 0.5, 1 and 2 kb show slightly higher than those of pure water at high temperatures, while they abruptly change at around 350, 400 and 420°C, respectively (Figure 1). It is quite interesting that NaCl changes its major dissolved species from $NaCl_{(aq)}$ to $Na^+ + Cl^-$ almost at around the above temperatures, implying a large effect of ionization of salts on the dielectric constants.

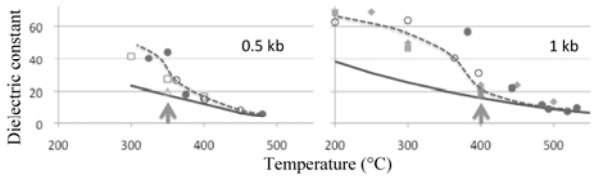

Figure 1: Dielectric constants of pure water (solid lines) and the "apparent" ones of 1 molal NaCl solutions (broken lines).

Experimental data of talc-quartz equilibria in brines [2] were used for consistency check by MIX99 [3] in which SUPCRT92 [4] and the Debye-Huckel equation for activity coefficients of aqueous species are included. The calculated solubilities of talc and quartz in brines were well consistent with the experimental results. Therefore, it can be said that the estimated dielectric constants are adequate as "apparent" ones to apply thermodynamic data of solutes in water solvents provided by SUPCRT92 to reactions in brines.

[1] Akinfiev and Zotov (1999) *GCA* **63**, 2025-2041. [2] Saccocia and Seyfried Jr. (1990) *GCA* **54**, 3283-3294. [3] Hoshino *et al*. (2000) *Res. Geol.* **50**, 185-190. [4] Johnson *et al*. (1992) **GCA 18**, 899-947.

In situ U-Pb zircon dating using laser ablation-multi ion counting-ICP-MS

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Precision and accuracy of laser ablation-inducctively coupled plasma mass spectrometry (LA-ICP-MS) U-Pb dating of accessory minerals is highly developed these years. Moreover the coupling of laser ablation systems to multicollector magnetic sector ICP instruments (MC-ICP-MS) has resulted in the ability to acquire accurate and prcise isotope ratios for many elements at high spatial resolution for its high ionization efficiency of the ICP source and simultaneous acquisition of ion beams having flat topped peak shapes.LA-MC-ICP-MS U-Pb dating has certain advantages when employed for large zircon population, expecially for ditrital zircon.

We report results of U-Pb dating of different zircon reference samples (91500, GJ-1, Plesovice, TEM) by laser ablation (Newwave UP 213nm Nd:YAG)-multi ion couting ICP-MS (Thermo Finnigan Neptune) under 25μm diameter. The array of four channeltrons and three faraday cup allows for simultaneous detection of ^{202}Hg(on IC5), ^{204}Hg, ^{204}Pb(on IC4), ^{206}Pb(on IC3), ^{207}Pb(on IC2), ^{208}Pb(on L4), ^{232}Th(on H2), ^{238}U(on H4) ion signals. The linerity and stability of the ion counters are better than 0.2% during any one analytical session, and ion signals were kept below 1×10^6 cps in almost all of the laser ablation analyses of zircon so as to prolong the longevity of the detectors. It was assumed that mass bias and U-Pb fractionation during the ablation process were similar for both the zircon standard and the samples. Data were evaluated by *ICPMSDataCal 3.4* (Liu, 2008) using a type of standard-sample bracketing method. Precision of measured Pb/U ratios in zircon after 20s of ablation is better than 5%(2SD), resulting in routinely achieved precision of U-Pb ages obtained by external calibration of ~1% or better. The resulting present U-Pb age for four zircon reference samples and two geological samples show an excellent agreement with the previously reported ID-TIMS or SHRIMP data.

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