Experimental research of metal mercury solubility in water

YURY V. ALEKHIN, NAIL R. ZAGRTDENOV* AND RENATA V. MUKHAMADIYAROVA

Lomonosov Moscow State University, 119991 Moscow, Russian Federation
(*correspondence: nailzag@yandex.ru)

The experimental works [3, 4] was devoted to solubility of elementary mercury in water in the range of temperatures 120-500 ^{0}C. The great number of papers [1, 2, 5] for an interval 20-120 ^{0}C is in the obvious contradiction with the reliable high-temperature data. Unusual nonlinearity of dependence lg m – 1/T for simple reaction Hg^0_{liquid} - Hg^0_{aq} forces to assume change of the dominating form in a solution in the field of low temperatures.

We had been suggested the version about complete dominance of form Hg^0_{aq} (dissolved) at high temperatures when solubility of elementary mercury is high also prevalence of the oxidized forms of mercury at the low. Position of mercury in a standard electrochemical voltage range of metals isn't an obstacle for occurrence of analytically significant concentration of the oxidized forms against the lowest solubility Hg^0_{aq} at small volatility of steams Hg^0_{liquid} in the field of low temperatures. The made experiments on solubility of mercury in an interval 20-80 ^{0}C in various oxidation-reduction conditions have confirmed our version. The good concordance of our data on solubility of mercury in reductive conditions with data [4] which extrapolated on 20-80 ^{0}C is obtained. For 20 ^{0}C linear extrapolation from area of high temperatures for Hg^0_{aq} gives quantity of solubility 1,99 ppb. We experimentally receive value 1,95 ppb. This value on two order more low, than usual total solubility in oxidizing conditions. Results of research allow to offer the simple version of temperature dependence of Hg^0 solubility and Henry's coefficients for equilibrium with liquid mercury in absence of the oxidized forms.

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Effect of temperature and mineralogical composition on the reactivity of shale: A comparison study of potential caprock from two potential CO_2 storage sites

B.L. ALEMU*, P. AAGAARD AND H. HELLEVANG

Department of Geosciences, University of Oslo, P.O.Box 1047 Blindern, N-0312 Olso, Norway
(*correspondence: b.l.alemu@geo.uio.no)

Two caprock shales, one from a proposed CO_2 storage site in Longyearbyen, Svalbard, and the other from a potential CO_2 storage site off-shore Norway, close to the Troll field, were used in this study. The shale from Svalbard was cored from the De Geerdalen formation close to the town of Lonyearbyen from a depth of around ~ 800m. On the other hand the shale from Troll field was cored from Upper Jurassic Draupne Formation from a depth ~ 1000m below see floor. Both samples have different mineralogical composition which is partly influenced by their respective diagentic history. The two samples were reacted in batch reactors under different temperature and constant pressure conditions. Crushed samples from both samples were reacted with a mixture of CO_2 and brine at a temperature of 250 °C, 100 °C and a constant total pressure of 110 bars. The experiment from 250 °C lasted 35 days each while the experiment from 100 °C lasted 70 days. In addition, control reactions using brine solution without CO_2 were run for high temperature experiments to discern effect of temperature-driven reactions from CO_2-enhanced reactions.

The results indicate different reactivity for both samples. The release rate of cations was affected both due to mineralogy and experimental condition. For example, K appeared to be maximum in samples reacted with brine only whereas Ca, Fe and SiO_2 were higher in samples reacted with mixture of brine and CO_2. More Ca was released from the De Geerdalen shale as it had more carbonate. On the other hand the solution from the Draupne shale released more Mg, K, Fe and SiO_2. Dissolution of carbonates was significant on the reacted solids from both samples as evidenced by the decrease in total inorganic carbon content. Compared to high temperature reactions, lower temperature reactions dissolved more carbonates. In addition, dissolution of carbonate was much more pronounced in the Draupne shale. XRD analysis of the samples also revealed some alterations of minerals in both samples.