Galena Reaction Rate in Synthetic Seawater

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Galena reaction rate in synthetic seawater and the effect of pH, dissolved oxygen and temperature were investigated in a batch reactor experiment. One gram of naturally occurring galena with grain size of 105-125 um was in contact with internally circulating 1.8 L synthetic seawater. The effect of salinity to the reaction rate was also assessed by running pure and diluted synthetic seawater. The effect of temperature was studied from 7°C to 30°C. Current data results to the following volumetric rate law:

$$R_{Galena} = -k(\frac{SA}{V})(m_{H^+})^{0.40}\left(m_{O_{2aq}}\right)^{0.86}$$

and molal specific rate law:

$$R_{Galena} = -10^{-11.45}(m_{H^+})^{0.40}\left(m_{O_{2aq}}\right)^{0.86}$$

where R_{Galena} is the specific rate in moles m^{-2} sec^{-1}, m_{H^+} is the molal concentration of H$^+$, $m_{O_2\,aq}$ is the molal concentration of dissolved oxygen, SA is the galena surface area and V is the volume of solution used. The specific rate law suggests that dissolved oxygen is more important in the dissolution of galena as compared to pH. An increase in temperature and salinity correlates to increased reaction rate.