

Applied kinetics aspects of ferric EDTA complex reduction with metal powder.

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Streszczenie

Nitrogen and sulfur oxides (NO_x and SO_x) emitted from fossil-fuel-fired facilities can be simultaneously absorbed into aqueous mixed solutions of sulfite and FeII , a ferrous ion coordinated to a ligand L (a chelate compound). Usually, the ligand L represents an anion of ethylenediaminetetraacetic acid (EDTA or edta). Nitrogen oxide (NO) sparingly soluble in water is promptly bound to the $[\text{FeII}(\text{edta})(\text{H}_2\text{O})]^{2-}$ complex to form the $[\text{FeII}(\text{edta})(\text{NO})]^{2-}$ compound. However, $[\text{FeII}(\text{edta})(\text{H}_2\text{O})]^{2-}$ chelate is oxidized to form $[\text{FeIII}(\text{edta})(\text{H}_2\text{O})]^-$ by NO, NO_2 , and O_2 , normally coexisting in flue gases. Because the ferric complex does not react with NO, the suppression of these undesired oxidation processes is a very important technological problem to be overcome. Thus, in this work, the reduction kinetics of ferric ion by metal was discussed on the basis of the kinetic data regarding the ferric ion reduction in aqueous solutions of $[\text{FeIII}(\text{edta})(\text{H}_2\text{O})]^-$ containing such pulverized metals as aluminum, tin, and zinc. The rate expression for the reduction of $[\text{FeIII}(\text{edta})(\text{H}_2\text{O})]^-$ by a metal powder was derived in terms of the rate-determining step approximation method. Laboratory-scale experiments were conducted in a recirculation-type glass reactor filled with 250 cm³ of solution. The influence of the following parameters on the reduction rate was investigated: (1) $[\text{FeIII}(\text{edta})(\text{H}_2\text{O})]^{0-} = 0.100\text{--}0.010$ M, (2) $[\text{metal}]^0/[\text{FeIII}(\text{edta})(\text{H}_2\text{O})]^{0-} = 10\text{--}100$, (3) $\text{pH}^0 = 3\text{--}9$, and (4) temperature = 20–80 °C. Zinc and aluminum powders were found to be effective reducing agents for ferric ions coordinated to EDTA. Similar experiments were carried out using a working solution in a simultaneous NO and SO_2 removal process as a solvent of $[\text{FeIII}(\text{edta})(\text{H}_2\text{O})]^-$ solution.

Adres publiczny

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