Research on the influences of high salt water on $CaCO_3$ dissociation

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Abstract. For the consideration of wastewater zero discharge, many coal-fired power plants reuse the reverse osmosis concentrated water and chemical drainage in the desulfurization system ,but studies of influence to the CaCO3 dissociation by highly concentrated saline wastewater are rare. This paper analyzes negative influences of all kinds of ions when seperately exist in absorption tower, discussed the negative effect mechanism of highly concentrated saline wastewater on the CaCO3 dissociation.This study provides the reference for engineer practice when predicting the CaCO3 dissociation with all kinds of ions in.

1. Introduction

From the view point of sustainable development ,the depth of water is one of the best measures for coal-fired power plants.Thus saline wastewater used for desulfurization system back, and then taking the desulfurization wastewater to a unified treatment is feasible.But little is known about the possible impact of[1].So we analyzes the existing in the salt water of various ion specific effects on the desulfurization system and clear the mechanism of action of key, which has far-reaching significance.

2. Mechanism of action

Various ions have different impact on the $CaCO_3$ dissociation by affecting the ionic strength、the surface tension of the limestone、he solubility of sulfate and the changes of chemical equilibrium. For example, the increase of concentration of C^{l}- will restrain the spread of H +, decreasing the $CaCO_3$ particle interface layer on the surface of H+ concentration and reducing the limestone dissolution rate. The increase of concentration of SO_3^{2} - and Mg 2+ will improve the circulation of serum alkalinity, so as to reduce the liquid phase mass transfer resistance, which is more conducive to the limestone dissolution[2-3].

3.The influences of various ions

3.1The influence of Cl^-

In slurry of WFGD system , chloride mostly exists in the form of CaC_l^2. With the increase of concentration of C_l- and will affect the decomposition rate of $CaCO_3$,changing the pH value, reduceing the removal rate of SO_2 . Ukawa [2] thinks when solution containing C_l-, will increase the ionic strength of solution, stopping the spread of H+.Decrease the concentration of H+ on the surface of the $CaCO_3$ particle interface layer, which increases the liquid phase mass transfer resistance, reducing the limestone dissolution rate.

3.2The influence of SO_3^{2-}

SO_3^{2-} will inhibits the solution of $CaCO_3$. Happens when high relative saturation sulfite sulphite serious inhibition. Phenomenon of sulfite serious inhibition is the running pH falling, which running pH is out of control. The utilization rate of limestone cannot maintain the use ratio we want even in the setting pH value,and the limestone concentration in the slurry will increase[3].

3.3 The infulence of SO_4^{2-}

The existence of SO_4^{2-} can promote the dissolution of the limestone.Because SO_4^{2-} and H^+ form HSO_4^-, the mass transfer coefficient will increase and the limestone dissolution rate can magnify,

thus improve the desulphurization efficiency [4]. Ca^{2+} and SO_4^{2-} form $CaSO_4$ consuming more Ca^{2+} in the solution,which make the rate of positive reaction increase

3.4 The influence of Al^{3+} or F^-

When joining Al^{3+} and F^- aloneor in the limestone solution , for the influence of limestone dissolution is relatively minor. And after adding Al^{3+} or F^- at the same time, the limestone dissolution rate will decline because of the formation of AlF_X. That cover on the surface of limestone, hindering the mass transfer factor between the liquid subject and the limestone particles, which seriously inhibit the dissolution of the limestone[5].

3.5The influence of Na^+

Na^+ can reduce the liquid mass transfer resistance and the resistance of the dissolution of limestone, effectively increasing the mass transfer coefficient and enhancement factor,making the limestone dissolve quickly[6].

3.6The influence of Ca^{2+}

In salt water The presence of Ca^{2+} is bound to affect the limestone dissolution.For the same ion effect, the greater the concentration of Ca^{2+} in the salty water, the stronger the inhibition of limestone, which make limestone solubility decrease[7].

3.7 The infulence of Mg^{2+}

The existence of Mg^{2+} can work wonderfully for limestone slurry desulfurization by a collaborative and promoting influence. Because the $MgSO_4$ in water solubility is higher than $CaSO_4$, leading to an elevated serum concentrations of SO_4^{2-}, making it easier to form precipitation with Ca^{2+}[4].

4. Conclusion

When high concentration salty wastewater use back to desulfurization system,Cl^-,F^-,SO_3^{2-},Al^{3+}andCa^{2+} shall be reduced to reduce the effects of the dissolution of the limestone.We can keep appropriate concentration of Na^+,Mg^{2+} and SO_4^{2-} existing in wastewater at the same time,and three kinds of ions can promote the dissolution of the limestone layer in different degrees.

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