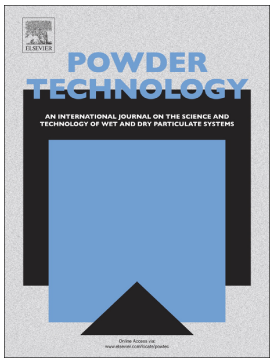

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Effect of calcium ionic concentrations on the adsorption of carboxymethyl cellulose onto talc surface: flotation, adsorption and AFM imaging study

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Abstract: The effect of various calcium ionic concentration on the adsorption of carboxymethyl cellulose (CMC) onto talc surface has been investigated using flotation tests, adsorption measurements and tapping mode atomic force microscopy (AFM) imaging. Microflotation tests indicated that the depression of talc depressed by CMC was increasingly enhanced with the increase of Ca^{2+} at pH 8.5. And within the pH range of 2-11.5, in the presence of Ca^{2+}, the depression of talc by CMC could be facilitated by Ca^{2+} stably. Adsorption experiments confirmed that with the increase of Ca^{2+}, the adsorbed CMC on talc increased at pH 8.5. AFM imaging revealed the morphology of adsorbed CMC were different in the absence and presence of various Ca^{2+} ions concentration. In the absence of Ca^{2+} ions, the morphology of adsorbed CMC consisted of randomly distributed salient point domains with a lower area fraction of surface coverage; in the presence of 10^{-4}mol/L Ca^{2+} ions the morphology mingled with salient point and reticulate adsorption; in the presence of 10^{-3} and 10^{-2}mol/L Ca^{2+} ions the morphology is a reticulate multilayer adsorption with a higher area fraction of surface coverage.

Keywords: Talc surfaces; CMC; Ca^{2+} ions; AFM; Adsorption

1 Introduction

Talc ($Mg_3Si_4O_{10}(OH)_2$) is a layered magnesium silicate mineral, which is commonly encountered with nickel sulfide ore, complex sulfide ore and platinum group metals ore [1-6]. The crystal structure of talc consists of layers of silica tetrahedral and magnesia octahedral (brucite, $Mg(OH)_2$), and one magnesia octahedral sheet is sandwiched between two silica tetrahedra sheets [7-9]. The surface of talc particle is consisted of two different surfaces, namely the basal plane and the edge [9].

Generally, because the silica tetrahedral is nonpolar, the basal planes of talc surface is uncharged, thus makes the basal planes hydrophobic. On the contrary, talc edges consist of charged Mg^{2+} and OH^- ions and, therefore, the edges of talc are likely to be hydrophilic [7]. Talc surface is occupied by approximately 90% of basal planes [9], therefore, talc is a naturally hydrophobic mineral. However，in some cases, a small amount of Ti^{3+} or Al^{3+} can substitute for Si^{4+} in the tetrahedral layer [10]， therefore basal plane of talc is with a trace of

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