Synthesis of clay-based nanocomposite by intercalation

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Introduction

Layered nano composites between layered aluminosilicate, montmorillonite and amino acid molecules, are prepared by intercalation. L-valine, L-threonine, L-glutamic acid, L-lysine, L-histidine and L-arginine are used as amino acid molecules. In the intercalation reaction, the solution pH plays an important role in preparing the nano composites; pH of the solution below 4 is favorable to obtain layered nano composites due to the zwitterionic nature of amino acid molecules. In addition, the basic side chain in of amino acid molecules has a crucial role in determining the structural stability of clay-amino acid composites; the basic amino acid such as L-arginine, L-lysine and L-histidine with basic side chain form stable intercalated nano composites through the strong intermolecular hydrogen bonding in the silicate layers.

Methods

The preparation of clay-amino acid composites is carried out by a typical intercalation reaction. At first, Na-montmorillonite is preswelled in distilled water for 24 hr (1 wt%), and the pH of the clay suspension is controlled by adding 1 mol/dm^3 HCl solution. The aqueous solutions of the amino acid are prepared separately by dissolving amino acids (3 times to the CEC of montmorillonite) in distilled water and the pH of the solutions are also controlled by titrating 1 mol/dm^3 HCl solution. Then the two solutions are mixed and react at 60 □ for 4 hr under continuous stirring. The reaction products are separated by centrifugation and washed thoroughly with distilled water. During the ion exchange reaction, the solution pH is varied in the range of 1.5 ~ 12.0 to investigate the pH effect on the intercalation reaction.

Results and Discussion

Nano composites of montmorillonite and amino acids are prepared as a function of reaction pH by a typical intercalation reaction. In the reaction, the solution pH and bisicity of amino acid molecules are crucial to determine the formation of montmorillonite-amino acid intercalation compounds and their structural stability. The basic amino acids such as histidine, lysine, and arginine form stable intercalation compounds. The zwitterionic nature and intermolecular hydrogen bond have determing effect on the intercalation reaction of amino acids and the stability of amino acid.

Biographical Sketch

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