CHAPTER I

INTRODUCTION

1.1 Motivation

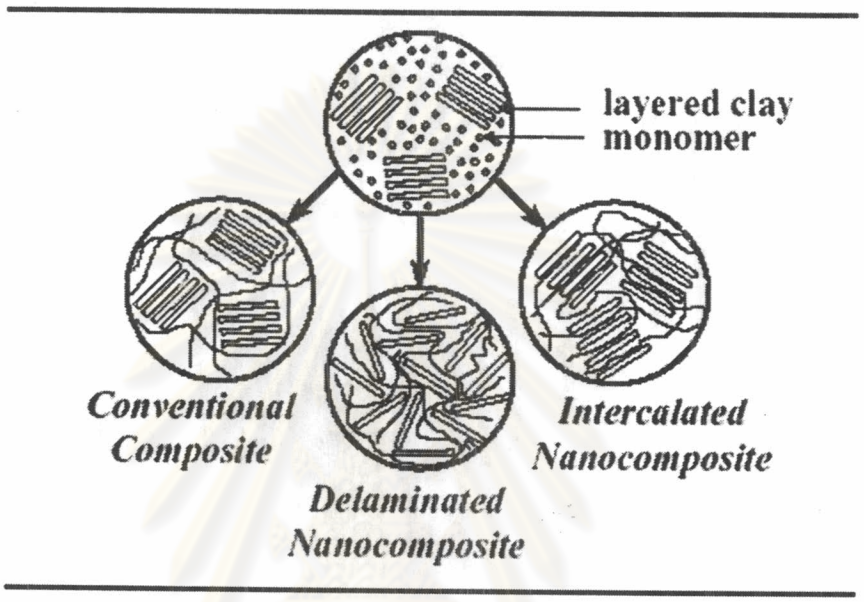
Polymer-clay nanocomposites is an emerging type of composite materials where a mixing between the clay, reinforced material, and a polymeric matrix take place in a nanometer scale. This leads to a maximum contact between both phases. As a result, a mechanical, chemical, electrical, and barrier properties of composite materials are improved [Le Baron et al., 1999, Hay and Shaw, 2000] over a conventionally filled polymers [Kojima et al., 1993 a, b,].

Many clay minerals such as smectite, koalinite and mica are often used as an additive to improve the properties of nanocomposites[Hay and Shaw, 2000]. The clay mineral consists of a platelet anisotropic particle, having a lateral dimension smaller than 2 μm with 9.5 °A in thickness, that stacks together, called tactoid. The clay mineral has a polar surface. The surface modification is often needed in order to improve the dispersion of the clay in monomer and/or polymer. This can be done by an treating the clay with an organic cation such as alkylammonium ion to make an organophillic clay

The first commercially available polymer-clay nanocomposite was introduced in 1987 by Toyota research groups [Han et.al., 2003]. Nylon 6-clay nanocomposites was prepared by reacting a modify montmorillonite with alkylammonium surfactants via in situ polymerization. These nanocomposites exhibit superior properties such as higher tensile strength, modulus, heat resistance, lightweight and less permeability to gas at a lower level of loading.

The properties of polymer-clay nanocomposite are depending on the dispersion of clay particles in polymer matrix [Fu and Qutubuddin, 2001]. Based on a dispersion of an individual clay layer in polymer, the polymer-clay nanocomposites can be categorized into three major types which are conventional, intercalated, and exfoliated nanocomposites. The first is the conventional composite or microcomposite where clay tactoids form an aggregated in the matrix. The second is the intercalated

nanocomposites. The polymer is intercalated into the clay interlayer. The last is the exfoliated nanocomposites where the individual clay layers are dispersed as nanolayer (the thickness less than 10 nm). This is the most desirable typed of nanocomposites where the barrier property is the main concern (Figure 1.1).



Figrue 1.1 Three type of composite materials

1.2 Objective

A main objection of this research is to investigate an effect of clay surface modification on the dispersion of the organoclay in a common organic solvent and in the polymeric matrix. The clay mineral has a resource in Lopburi, Thailand.

1.3 Scope

The scope of this work is divided into three parts,

- Study an effect of the type of alkylammonium ion and its absorption process in montmorillonite (Figure 1.2 b)
- Study an effect of edge treatment of montmorillonite by coupling agents on a rheological of the organoclay (Figure 1.2 c)

- Study the effect of surface treatment on the formation of polystyrene-clay and nylon6-clay nanocomposites

The scheme of modification has been shown in the Figure 1.2

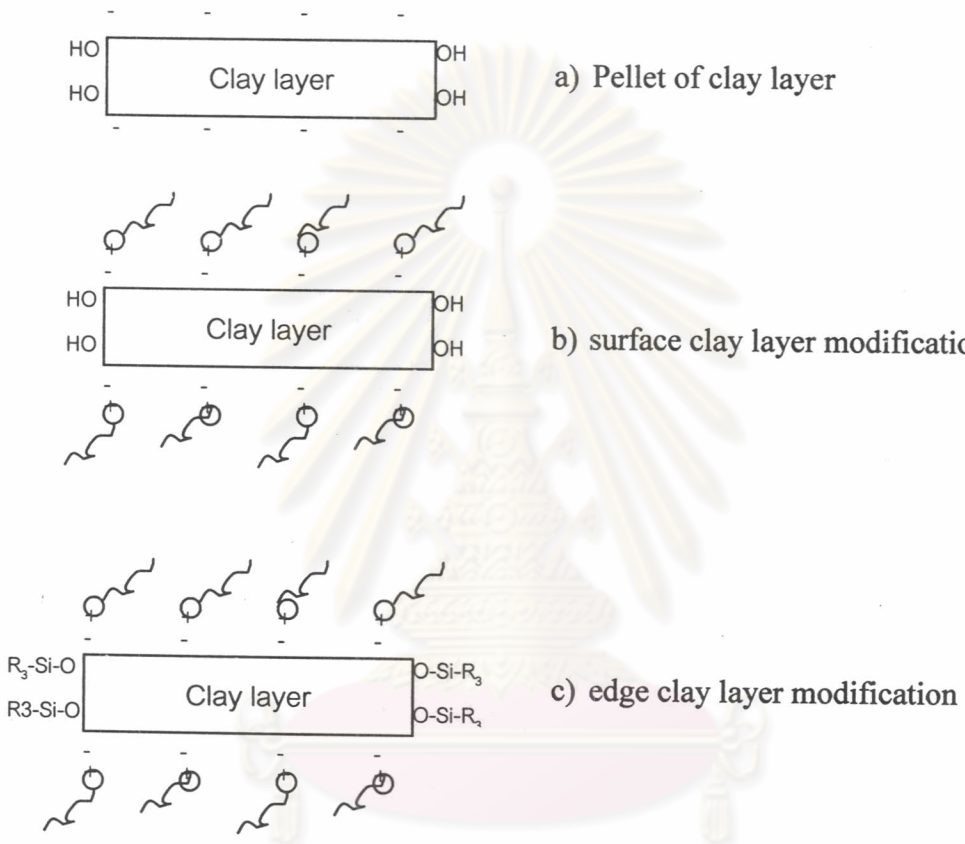


Figure 1.2 Cartoons represent the clay modification