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ORIGINAL PAPER

Preparation of aluminium ammonium calcium phosphates using microwave radiation‡

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Microwave radiation was used in the acquisition of aluminium ammonium calcium phosphates. The substrates such as $CaCO_3$, H_3PO_4, aqueous ammonia were reagent grade, whereas $Al(OH)_3$ was prepared afresh. The influence of process parameters (pH 6 ± 2, molar ratios of Al^{3+} : Ca^{2+} : PO_4^{3-} in the substrates, respectively 0.31 : 0.62 : 1; 0.5 : 0.5 : 1; 0.72 : 0.36 : 1) on the phase composition and the product properties was determined. Statistical software STATISTICA 10 was used for planning and evaluation of the experiments. The process parameters making it possible to acquire the material with the anticipated physicochemical properties were determined based on statistical evaluation of the planned research by the plan fractional factorial design at three levels $3^{(k-p)}$. The phase composition of the samples was studied using XRD analysis. The specific surface area was calculated using the BET method and the particle size was determined by LSM. Materials with a molar ratio of Al^{3+} : Ca^{2+} and Al^{3+} : NH_4^+ in the range of 0.07–0.76 and 0.75–3.4, respectively, with an absorption oil number of 36–56 g per 100 g, S_{BET} within 8.2–73 m^2 g^{-1}, and particle size in the range of 156–252 nm were obtained.

Keywords: microwave radiation, anti-corrosive pigments, aluminium ammonium calcium phosphates

Introduction

Active passivated pigments constitute an important group of substances exhibiting an inhibitory action in the paint coating in relation to the metal base. A corrosion inhibitor should not only mitigate corrosion but also be compatible with the environment. A corrosion inhibitor can mitigate corrosion in two ways. In some cases, the corrosion inhibitor can transform the corrosive environment into a non-corrosive or less corrosive environment through its interaction with the corrosive species. In other cases, the corrosion inhibitor interacts with the metal surface and provides protection of the metal from corrosion. Thus, depending on the mode of the interactions, there are two broad classes of inhibitors: environment modifiers and adsorption inhibitors (Sastri, 2011).

Environmental protection issues restrict the use of toxic pigments; hence a new generation of pigments, such as phosphates of zinc, molybdenum, calcium, and aluminium, has been developed and widely used as anti-corrosive pigments. However, the environmental regulations dealing with heavy metals are becoming stringent and development of a more efficient and more environmentally friendly pigment is required (Park et al., 2002).

An alternative approach involves the use of a protective coating containing inorganic anti-corrosion pigments. With regard to this, recent ecological and toxicological measures have led to the search for potential replacements for lead- and chromium-containing pigments (Mošner et al., 2000).

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