

PREPARATION OF STABLE SUSPENSIONS OF DELAMINATED KAOLINITE BY COMBINED DIMETHYLSULFOXIDE-AMMONIUM FLUORIDE TREATMENT: DISCUSSION

Key Words—Delamination, Dimethylsulfoxide, Growth spiral, Kaolinite crystal, Screw dislocation.

N. Lahav (1990) reported results on the dissociation of kaolinite crystals into their lamellar components by combined dimethylsulfoxide (DMSO)-ammonium fluoride treatment. In fact, the author used the hydrated kaolinite synthesis method described by Costanzo *et al.* (1984). Lahav considered that after the treatment, kaolinite crystals had to delaminate into their lamellae. However, data from his Table 1 show insignificant increase in the weight percentage of the $<0.12\ \mu\text{m}$ size fractions. Unfortunately, the author did not give more detailed data on the size fractions of the kaolinite used, so it was impossible to estimate the real extent of kaolinite delamination.

The problem of delamination of kaolinite into its lamellae has not resolved up to now. In my opinion, this is due to the fact that construction of kaolinite crystals is more complicated than usually accepted.

Recently, Sunagawa and Koshino (1975), Chekin *et al.* (1977) and Chekin and Samotoin (1980) studied kaolinites by the gold decoration technique of electron microscopy and found beautiful growth spirals of various types on the basal planes of kaolinite crystals. The density of the screw dislocations varied from $n \cdot 10^7\ \text{cm}^{-2}$ to $5 \cdot 10^9\ \text{cm}^{-2}$, and a single crystal contained one or more screw dislocations (Chekin and Samotoin, 1980).

On the basis of these findings, a new model for kaolinite crystals was suggested (Chekin and Samotoin, 1980): that a kaolinite crystal is made up of one or more unit layers wound around one or more screw-dislocation axes. Therefore, in order to separate a kaolinite crystal into its lamellar components, it is necessary to overcome the bonding energy that holds layers together and tears layers across.

Recently, some peculiarities of the kaolinite intercalation process were satisfactorily explained (Chekin, 1982) on the basis of a helical crystal model with screw and edge dislocations. The main conclusions of the study are quoted below:

“Results on the complex of kaolinite with dimethylsulfoxide and a survey of the published data of these organic complexes show that some of the specific fea-

tures in the production of these complexes are due to the helicoidal structure of the kaolinite crystals including growth, screw, and edge dislocations.

“The helicoidal structure explains the formation only of ordered complexes with regular intercalation of layers of kaolinite and organic molecules even at the earliest stages of swelling, and the retention of the three-dimensional order in the kaolinite layers in the complexes.”

During intercalation and desorption of molecules such as DMSO or others, kaolinite must conduct itself like an elastic spring. The intercalation of DMSO molecules by kaolinite only moves unit layers 0.4 nm apart, which is probably not enough for lateral rupture of layers. To prepare lamellar components of a kaolinite crystal, it is necessary to move unit layers greater distances apart and to overcome some shearing strength limit. In all probability, the limit was overcome in experiments conducted by Weiss *et al.* (1981), in which kaolinite unit layers were moved 3.9 nm apart and some thin tubes (not platey particles) were formed.

I consider that the intercalation of DMSO in kaolinite cannot delaminate its crystals at all.

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