

DETERMINATION OF SURFACE FREE ENERGIES AND ASPECT RATIO OF TALC

by

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ABSTRACT

Microcalorimetric measurements and contact angle measurements were conducted to assess the surface chemistry of the mineral talc. The contact angles were performed on both flat and powdered samples and the results were used to determine the surface free energy components and parameters (SFEC) using the acid-base theory for solids, according to the van Oss-Chaudhury-Good approach. It was found that the surface hydrophobicity of talc increases with decreasing particle size up to a limit after which hydrophilicity (polarity) increases. The increase in hydrophobicity was attributed to the increase of the delamination of the lamellar talc particles. Delamination is a comminution mechanism that preferentially exposes talc's hydrophobic basal planes, while fracture is another mechanism that breaks the lamellae, rupturing covalent bonds thus exposing more hydrophilic edge surfaces. The decrease in hydrophobicity, beyond a given particle size, could be related to the prevail of fracture over delamination during grinding which generated more hydrophilic edge surfaces.

The flow microcalorimetry combined with thin layer wicking allowed the separate estimation of the SFEC at the basal plane and edge surfaces of talc. The results suggested that the basal surface of talc is monopolar basic, while the edge surface is monopolar acidic, which are in agreement with the crystal structure of the mineral.

The combination of two particle size distribution techniques, which are based on different physical principles, permitted the quantitative determination of the aspect ratio of highly anisometric particles, such as talc. The same trend obtained using flow

microcalorimetry was observed for the evolution of the aspect ratio as a function of particle fineness, i.e. the fracture prevails over delamination after achieving a maximum aspect ratio value of about 35. The agreement between two distinct methods was considered rather encouraging.

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DEDICATION

“Give a man a fish and you feed him for a day. Teach a man to fish and you feed him for a lifetime.”

Chinese proverb

I would like to dedicate this work to my parents, Ivaldo Pereira Lobato and Maria Elena de Castro Lobato. With their love, wisdom and guidance they thought me ‘how to fish’.

DEDICATÓRIA

“Dê um peixe a um homem e você o alimenta por um dia. Ensine-o a pescar e você o alimentará por toda a vida.”

Provérbio chinês

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