CHAPTER 7

FUTURE WORK

The present study was divided into four parts, each of which is still an on-going research. Based on the results obtained, following recommendations can be made:

1. The results presented in this report showed that particle size is an important factor affecting various surface properties. For example, Select-A-Sorb and Mistron Vapor-P, whose average particle sizes (d_{50}) were smaller than the other talc samples tested, gave the lowest surface free energies (γ_S) and, hence, were most hydrophobic. This finding suggests that the ratio between the basal and edge surfaces increases with decreasing particle size, which in turn suggests that the breakage of the layer-structured mineral occurs preferentially along the basal plane. There is also a possibility that different grinding mills break talc particles differently. Certain type of mills may preferentially break talc particles along the basal planes, resulting in the production of more hydrophobic talc. It was suggested that jet mills produce talc products with higher aspect ratios than roller mills or attrition grinders (Yordan, 1999). It would be interesting to carry out surface free energy characterization on a series of talc samples pulverized to different sizes using different types of mills.
2. It was shown that the surface free energy of the basal surface of talc is much smaller than that of the edge surface, suggesting a substantially higher surface hydrophobicity of the basal planes. However, this information was obtained using just one talc sample (from Yellowstone ore deposit) that is ground to different fineness. It is possible that macrocrystalline and microcrystalline talc samples may have different aspect ratios and hence, different values of surface free energies at the basal and edge surfaces. Therefore, surface free energy characterization of basal and edge surfaces should be extended to various talc samples that are produced from different ore deposits.
3. Microcalorimetric measurements could be extended to measure the heat of immersion values of other high-energy apolar liquids such as methylene iodide, 1-

bromonaphthalene or *cis*-decalin on various talc samples so that the contact angles could be obtained. By doing these measurements, the Lifshitz-van der Waals surface free energy component (γ_S^{LW}) obtained from heat of immersion of n-heptane on talc samples could be compared. Also, flow microcalorimeter could be used to study the magnitude of heat of adsorption enthalpies of various organic acids and bases from acidic, basic and neutral solvents so that the difference between the acid-base surface properties of various talc samples would be determined in a more quantitative manner.

4. It has been found that flotation technique is not able to reduce the TiO_2 content in the beneficiated east Georgia kaolin to the required level (i.e. below 1.0%) and increase the GE brightness values higher than 90%. This was essentially attributed to the ultrafine particle size distribution of anatase particles that prevented them attaching to the air bubbles during flotation. It would be interesting to find some types of polymeric hydrophobizing agents for aggregating anatase particles and increasing probability of attachment. It is expected that the availability of such reagents will not only enhance the efficiency of removal of anatase from kaolin, but will also increase the flotation kinetics.
5. It has been shown in Chapter 5 that in selective flocculation experiments, the best results were obtained when using moderately anionic polymers (i.e. 20-40% anionicity) for flocculating anatase impurities from kaolin clay. However, the polymer flocculants with very low anionicity (e.g. less than 10%) and very high anionicity (e.g. higher than 75%) did not adsorb onto the anatase particles. As a result, the separation efficiency was very poor. It would be very interesting work to find such polymer flocculants with the same molecular weight (M. W. ≈15 million), but varying anionicities from 5% to 95% and to study the adsorption mechanism of polymers onto anatase surface using microcalorimetry, FTIR, UV and ESCA (XPS) techniques etc.