CHAPTER 4

CONCLUSION & SUGGESTIONS

CHAPTER 4

CONCLUSION

The effects of a range of additives, i.e., cyclohexane multi carboxylic acids, amphoteric amino acids, copolymers and 2-hydroxyethyl cellulose (HEC) at a range of concentrations on the rheological properties (the yield stress and viscosity) of ZrO_2 and TiO_2 suspensions have been illustrated and discussed in detail . A range of colloidal forces have been invoked in order to explain the various yield stress and viscosity behaviour. The forces illustrated are steric stabilization, hydrophobic flocculation, bridging flocculation, hydrogen bonding, charged patch interaction, depletion flocculation and depletion stabilization. The ionic strength effect from the excess NaOH trapped in the TiO_2 suspension from the NaOH treatment of the TiO_2 powder and as a result of pH adjustment with nitric acid solution in both the TiO_2 and ZrO_2 suspensions have also been discussed.

The forces that have large effect on the rheological properties of ZrO_2 and TiO_2 suspensions in the presence of cyclohexane multi carboxylic acids are steric stabilization, hydrophobic flocculation and bridging flocculation.

The effects of the amphoteric amino acids on the rheological properties of ZrO_2 and TiO_2 suspensions have been discussed using steric stabilization and hydrogen bonding. The various pattern of shifting of the pH of maximum yield stress in the presence of various amphoteric amino acids have been explained using the various pK_i values of the acids.

Charged patch interaction was invoked to discuss the effect of the copolymers on the yield stress-pH behaviour of the ZrO_2 suspensions.

The bridging flocculation - steric stabilization - depletion flocculation - depletion stabilization phenomena that can occur on increasing concentration of polymer chains in colloidal dispersions has been applied to discuss the effects of various molecular weights of HEC on the rheological properties (i.e., yield stress and viscosity) of TiO_2 suspensions. The significant shear thinning behaviour of the TiO_2 suspension in the presence of HEC-15 000 was also discussed by determining the power-law exponent, n of TiO_2 suspensions without HEC-15 000 and in the presence of various concentrations of HEC-15 000 at various pH.

SUGGESTIONS

In continuation to this project, further studies such as adsorption measurements can provide fresh hope on the confirmation of certain interpretation of the results obtained through this project, for example, to confirm the different behaviour of ZrO_2 and TiO_2 in the presence of 0.8dwb% of trans-1,4-cyclohexanedicarboxylic acid which probably be due to the different degree of adsorption of the additive on the various mineral oxides.

Measuring the mineral oxide particle sizes (and size distribution) using an optical microscope could probably give a better idea on the adsorption of additives on the particles by determining the diameters of the particles before and after adsorption.