Dispersant Optimisation

Functional Fillers for Plastics 2003
Atlanta Georgia

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Outline

• What are dispersants? Why do we use them?
• What is the present technology?
• How it can be improved?
• Method for optimising surface treatments
• Conclusions
DISPERSION ADSORPTION

\[ \text{CaCO}_3 \quad \text{SiO}_2 \]

Stearic Acid Molecule

\[ \text{Silane Molecule} \]

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STEARIC ACID ADSORPTION

Effect of specific interactions on the amount of adsorbed stearic acid.
Bonded stearic acid related to a unit surface for: (○) chalk, (△) marble,
(▽) talc, (□) silica.

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HEAD AND TAIL CONCEPT

Stearic Acid

An Alkyl Silane

Surfactant "Head"

Surfactant "Tail"
EFFECT OF CHAIN LENGTH ON
VISCOSITY

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CALCIUM CARBONATE

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Viscosity* (Pa*s)

Shear frequency (Hz)

Squalane/CaCO3/Treatment 100/20/0.2 wt%
DOLOMITE

Shear frequency (Hz)

Viscosity* (Pa*s)

- none
- dodecanol
- dodecylamine
- dodecytri-C₁₃-silane
- lauric acid

Squalane/Dolomite/Treatment 100/40/0.2 wt%
DOLOMITE

Shear frequency (Hz)

Viscosity* (Pa*s)

Squalane/Dolomite/Treatment 100/40/0.4 wt%
MICA

Viscosity* (Pa*s) vs. Shear frequency (Hz)

- none
- Na-dodecyl sulfate
- 1-dodecyl-2-pyrrolidinone
- Na-dodecylbenzene sulfonate
- dodecyl aldehyde

Squalane/Mica/Treatment 100/20/0.2 wt%
MICA

Shear frequency (Hz)

Viscosity* (Pa*s)

none
40S (aminosilane)
dodecanol
dod.benz.sulfonic acid
2-dodecen-1-ylsuccinic
lauric acid
do decyl tri-C1-silane
do decylamine

Squalane/Mica/Treatment 100/20/0.2 wt%
TALC

Shear frequency (Hz)

Viscosity* (Pa*s)

- none
- Na-dod.benz.sulphonate
- dodecyl aldehyde
- dodecanol

Squalane/Talc/Treatment 100/20/0.2 wt%
TALC

Viscosity* (Pa*s)

Shear frequency (Hz)

Squalane/Talc/Treatment 100/20/0.2 wt%
OPTIMUM LEVEL BY FLOW INDEX CaCO$_3$

CaCO$_3$(MX): 2-Dodecen-1-yl succinic anhydride
FLOW INDEX METHOD

DOLOMITE

Dolomite (A2) : Lauric acid

Flow index  (g/min)

Treatment level  (wt%)

Dolomite (A2) : Lauric acid

0.37%*

*converted to equivalent moles of Safacid 16/18 MS = 0.50%
Conclusions

- Surface treatments for polymers have been hard / expensive to develop
- The rheological method gives a systematic way to develop and optimise treatment
- The chemical type and level can be adjusted quickly without special equipment
- The results have been verified for the fillers in PP homopolymer

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