A Systematic Approach to Surface Treatment of Mineral Fillers

Dr. Chris DeArmitt (CChem MRSC)
Senior Project Manager
Electrolux Core Technology & Innovation
Outline

• Why surface treat fillers?
• What is the state-of-the-art?
• How can we make improvements?
• The system: finding the right treatment type and the optimal dosage
• Focussing on just the essential properties
• The results
• Conclusions
Why surface treat fillers?

The main reasons:

- Improved processability
- Improved dispersion
- Higher filler loadings are achievable
- Improved mechanical properties, especially impact strength
- Reduced need for antioxidant
What is the state-of-the-art?

- Silanes are effective on silica, stearic acid is good on calcium carbonate.
- For other fillers and pigments there are no recognized optimal treatments types.
- Often 1 weight % of additive is used, irrespective of the actual amount needed.

Surface treatment today is more like a black art than a science!
How can we make improvements?

We need systematic methods!

- A method to find the most effective surface treatment for any given filler or pigment
- A method to determine the right amount to add
- A way to accurately judge the results and work out if the surface treatment gives worthwhile benefits
Finding the right treatment type and the optimal dosage level

- It is possible to systematically select a surface treatment type that is best for any given filler or pigment.
- Simple, fast, inexpensive rheological tests show which type of treatment adsorbs best.
- The rheological test detects how well dispersed the filler is.
- The same test shows which level to use.

Dr. Chris DeArmitt CTI-M +46 8 738 6439
Focussing on just the essential properties

- Many processing and mechanical properties are effected by surface treating the filler
- Very hard to decide whether treatment is beneficial and cost-effective

In reality, usually only three properties are essential:
- VMFI (melt flow index modified to be valid for composites)
- Modulus
- Elastic limit (the true yield stress)
The results

For PP filled with calcium carbonate:

• Materials costs reduced by over 5 %
• Increased filler loading from 40 weight % to over 50 weight % with no change in processability
• Increased tensile modulus by >35 %
• Increased the elastic limit by > 5 %
• Improved the oxidative stability
Conclusions

• Surface treatment can be very beneficial and cost-effective
• Systematic methods exist for optimizing the treatment type and level
• It is possible to focus on just a few properties to make interpretation easier
• Lower materials costs, better processability and better mechanical properties