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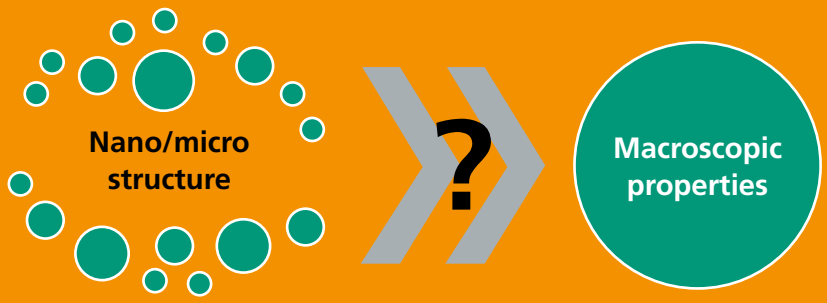

ON- AND INLINE CHARACTERIZATION IN COMPOUNDING PROCESSES

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The use of functional nanoparticles in polymers is one of the most promising but also one of the most challenging uses of this new material class. Low quantities of nanoparticles in these polymer nanocomposites (PNCs) improve barrier properties, fire resistance, electrical conductivity, optical properties and/or mechanical properties. In contrast to conventional fillers, the properties achieved with nanoparticles depend much more on a precisely controlled dispersion, deagglomeration and distribution of the filler in the polymer composite. Unfortunately today's state of the art in characterising the dispersion properties involves the use of time- and cost-intensive offline methods. This results in comparably high technical and economic risks, as the most important properties of the composites can only be determined long after the production. This contributes to the comparably high price of the materials, due to a high economic loss if the offline characterisation should indicate problems with the composite produced.

Fraunhofer ICT is working on characterization technologies together with partners in order to adapt these for material property monitoring and control during continuous processing, mostly in the twin screw extrusion line.

One of the main focusses is to adapt technologies, which give information about the nanocomposites structure in larger volumes (mm^3).

The second focus is on robust, cost-efficient inline sensors capable to be used in the rough conditions of polymer processing (temperature, pressure, vibration, dust).

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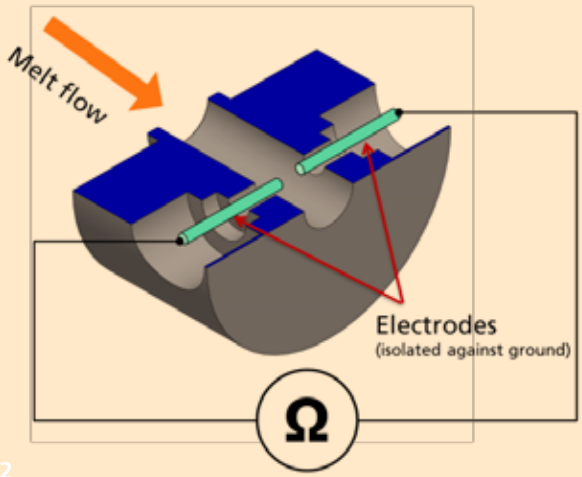


2

Some of the most important properties and sensor technologies are:

- Characterization of dielectric material properties for structure analysis
  - measurement of dielectric properties gives information about structure of the material
- Inline electrical resistivity sensor
  - cost-efficient electrical resistivity sensor can be easily mounted to processing lines
- Spectroscopy: Different spectroscopic measurements (UV-Vis, NIR, Raman, microwaves) can characterize chemical species, follow conversion in reactions, charactrize dispersion status
- Inline capillary viscosimetry (together with Gneuss Kunststoffe GmbH, EU funded Projects InnoREX and NanoOnSpect)
  - Inline viscosimetry can detect dispersion status and give estimations about molecular weight

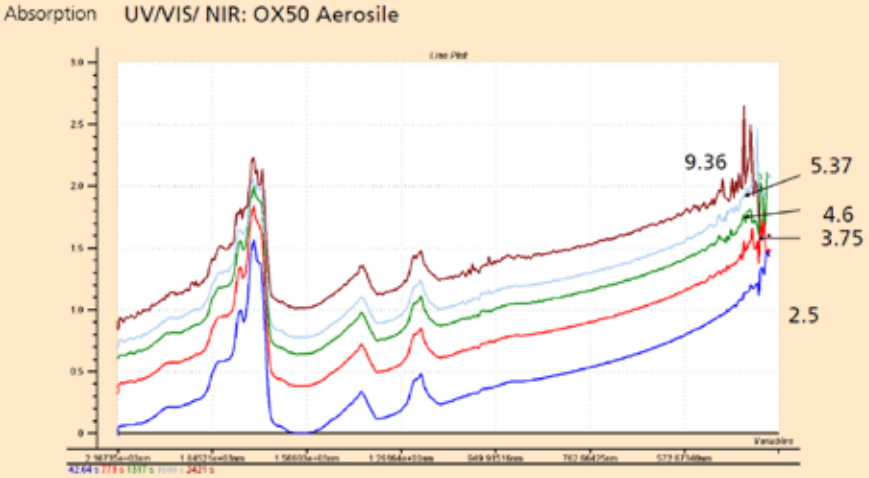
Our offer

We offer access to all the developments done in the frame of funded projects in order to evaluate the benefits for your specific application, either in characterization, processing or process control.

Funding

The development of some of the characterization techniques has been carried out in the frame of the funded projects, which have received funding from the European Union Seventh Framework Programme (FP7/2007-2013) under grant agreement n° 309802 and 263406.

Characterization of filler content (wt-% SiO2 in Polypropylene) during compounding.



1 *onBOX characterization tool for multiple measurements.*

2 *Characterization tool for electrical resistivity measurement.*