Surface-modified nanoparticles endow coatings with combined properties

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Fabricators and processors alike demand consistently high quality for their intermediate and final products. The properties of these goods usually also have to meet specific requirements. Particularly the surfaces of workpieces or mouldings are expected to exhibit several different functions at one and the same time, depending on the industry. Robustness, unchanging appearance, mar resistance, impact resistance or UV stability may be required, for instance. The INM – Leibniz Institute for New Materials uses nanoparticles as design element for such multifunctional coatings. These nanoparticles are specifically adapted to the particular application by Small Molecule Surface Modification (SMSM).

How this approach can be used to produce custom-tailored coatings will be demonstrated at the TechConnect World trade fair on 15 and 16 June in Washington DC, USA, where the INM will be presenting this and other results. Working in cooperation with the VDI Association of German Engineers it will be showcasing its latest developments at Stand 301 in the German Area.

Depending on which property is desired, the nanoparticles used can be surface modified with organic moieties. Small Molecule Surface Modification (SMSM) bestows specific combinations of desired properties, for example hydrophilic, hydrophobic, adhesive, anti-adhesive, acidic, basic, inert or polymerizable.

Nanoparticles thus modified are used to develop nanocomposites: they

combine the physical solid-state properties of e.g. ceramics or semiconductors with classic polymer-processing technology. Titanium dioxide, barium titanate, indium-tin oxide or zirconium dioxide, for instance, are used as nanoparticles. In addition to the chemical intrinsic composition of the nanoparticles and their SMSM surface treatment, the properties that are attainable for the desired coatings also vary with the size and dispersal mode of the nanoparticles.

INM's composite systems are produced via wet-chemical processes. The modified nanoparticles and additives combine with a polymer matrix (an epoxy resin, an acrylate, a polyimide for example) or a hybrid matrix (organic-inorganic) to produce a coatable Nanomer composite system.

"The modular principle makes it possible to achieve a number of properties at one and the same time in one material," explains Carsten Becker-Willinger, head of the program division Nanomers, "it helps us to respond in a highly systematic way to the different needs of industry," the chemist summarizes the potential of nanocomposite technology.

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