The use of nanoadditives to improve scratch resistance of radiation curable coatings

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Introduction

The reason for coating surfaces is to protect or to decorate surfaces in order to preserve or change and adjust surface appearance. Coatings technology has developed over centuries into a sophisticated piece of technology and is currently taking the next step by utilizing nanotechnology. Adding small amounts of nanosized materials can significantly improve surface properties to maintain surface appearance or to add additional functionality to those surfaces.

Scratch resistance

One broad area where nanotechnology is giving hope for a significant improvement is the area of improved scratch resistance while not affecting gloss or transparency. Adding small amounts of 0,25 – 2,00% of hard inorganic oxides made of for example out of Silica or Alumina can lead to those improvements. When measuring gloss retention (= gloss after scratch test divided by gloss prior to scratching) a standard UV coating can achieve up to 30-50% of gloss retention. Adding less than 1% of 20 nm Alumina to it these values depending on test method are increased to >95%. Furthermore the combination of Alumina with silicone or fluorinated surfactant-like molecules can even further enhance the effect of scratch resistance while lowering the dosage of Alumina that needs to added. Applications areas for such materials are flooring coatings as well as high value wood coatings where scratch resistance is needed.

UV protection

Another feature that can be improved using nanomaterials is UV protection. Nanosized ZnO offers a unique combination of UV absorbance and low refractive index visible light scattering making it a very promising material for long lasting UV protection. In addition in UV- or E-beam cured coatings the inorganic absorber is not affected by the radiation thus it maintains its activity even after curing. After 2000 h of accelerated UV-A testing discoloration using nanosized ZnO can significantly be reduced and it is expected that the effect will last because of the inorganic nature of the UV absorber.

Summary

Nanotechnology can offer significant improvements in coating properties. The challenge is to make nanomaterials accessible in a format that these materials can easily be added to coating formulations. Pre-dispersed nanoadditives are the most promising materials that can be used as “Ready-to-Use” masterbatches in coating applications.