

## A route to higher performance of waterborne UV-curable coatings

### - despite pigments

*How could a high performance be obtained in pigmented UV-curing coatings when the pigments absorb all or parts of the UV-radiation? A possible route investigated in this project is to combine oxidation of unsaturated fatty acids with the reactions found in UV-curing coatings.*

Coating materials are found on many different objects, for example floors, chairs, ceramics, airplanes, and cars. The coatings should therefore have different performances depending on the application of the objects. However, it can be said that the main purpose of a coating material is to produce a both protective and decorative film of an object, giving the object longer lifetime and better-looking surface. To produce this protective film of an object, the coating material must be cured in some way.

A common industrial way to achieve curing of a coating material is to use UV-radiation to initiate the curing reactions of so-called acrylate groups. The acrylate groups are usually found in the polymers that the coating mainly consists of. During the curing reactions, the polymers are crosslinked, which means that they are reacting with each other to form a coherent network. Generally, a highly crosslinked polymer network gives a high performance of the coating. Clear and white coatings on objects with simple geometry are usually fully cured when subjected to UV-radiation. But this is unfortunately not the case for neither pigmented coatings nor for coatings applied on objects with shadowed zones that the UV-radiation cannot reach.

As is commonly known, pigments absorb light and UV-radiation, giving poorly cured coatings and therefore poor performance too. This becomes a problem when a UV-curable coating must have a high performance while at the same time be pigmented. A kitchen cabinet door is an example of such application. The door must withstand not only everyday chemicals used, for example coffee and ethanol, but also other stress factors as for example scratches and impact forces. So, how do we overcome the problem with insufficient UV-curing?

Oxidation of unsaturated fatty acids is used in air drying alkyd paints, for example the paint normally used for houses. An idea of how to achieve high curing of pigmented coatings is to combine air drying with UV-curing. If these two types of curing techniques could be combined, a moderate cured coating could be achieved instantly by subjection to UV-radiation while the rest of the curing could occur with time, continuously initiated by the oxidation of the fatty acids.

This project investigated and concluded that oxidation of unsaturated fatty acids from linseed oil and soya beans can initiate the curing reactions of the acrylate groups found in the polymers of a coating material. Although the required high performances and high curing were not achieved, the project could be a first step towards further investigations of the potentials in combining the techniques used in UV-curing and in air drying. The project also opens up for using an additional curing technique by investigating the positive effect of drying at higher temperatures.