



How to formulate ...UV curable plastic coating

A typical formulation for plastic coating is composed of

- **A main binder** (often an oligomer or a multifunctional monomers)
- **Di or tri-dunctionals Monomers** to reinforce some properties (adhesion, water permeability) and to decrease the viscosity of the formulation.
- **Mono functional acrylate** which helps adhesion and dilution

But as it exists a lot of substrates, a variety of applications, Sartomer has developed a wide range of oligomers and monomers to help the formulator.

On this paper, we've focused on one substrate : polycarbonate and we've showed the different possibilities to find the right properties with Sartomer monomers and oligomers.

Regarding the **main binder**, the formulator often uses an highly functional oligomer acrylate for its good hardness and excellent abrasion resistance such as hexafunctional urethane acrylate (**CN9010EU**).

Nevertheless, other grades could give interesting alternative or complementary solutions:

- **CN9165** aromatic urethane acrylate when yellowing is not an issue
- **CN122A80**: hard epoxy acrylate (excellent temperature resistance)
- **SR399, SR295** multifunctional acrylates which offers a good scratch resistance
- Low viscous urethane/epoxy for a 100% solid solution: **CN922, CN925, CN9251, CN9276** as urethane and **CN132, CN133** as epoxy acrylate

This list could be completed by other urethanes grade with lower functionalities when the substrate requires a flexible coating. In this case, we will chose

- A trifunctional urethane grade such as **CN9278B80** or **CN998B80**
- A difunctional urethane such as **CN9012, CN981, CN9200**

On the other way, if even with a multifunctional urethane acrylate, the surface hardness is not enough, **SR368** and **CN890** could be envisaged in addition.

Depending on their backbones, **Di or tri-dunctionals Monomers** will have different roles in a formulation or will reinforce the oligomer behaviour:

- Adhesion/abrasion resistance compromise : **SR349, SR 833S**
- Wetting: **SR9020, SR9003**
- Yellowing resistance: **SR606A**
- Adhesion/dilution: **SR238, SR341**

If adhesion is not enough, a use of **Mono functional acrylate** could be beneficial. In this category we could quote:

- **SR531**: no odour, excellent yellowing resistance
- **SR506D, CD420**: monomers with high Tg (65-70 °C).
- **SR339C**: high refractive index (RI)
- **SR285**: good adhesion

The following starting point formulations for PC (in all case adhesion is perfectly obtained) illustrate all these recommendations:

- PC1 was designed around a difunctional urethane **CN965**. The good hardness and chemical resistance is given by **SR368** and **SR295**. To obtain a good adhesion, 20 % of **SR238** was added.

PC1	
CN965	14%
SR368	29%
SR295	19%
SR238	22%
Darocur 1173*	4%
Irg 184*	3%

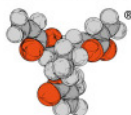
*: Supplied by Ciba

- PC2 was designed around a low viscous urethane **CN922**. As difunctional **SR344** gives the adhesion. At the end, The good hardness PC2 has an excellent reactivity.

PC2	
CN922	71%
SR344	24%
Darocure1173*	4%
Irgacure 184*	1%

* : Supplied by Ciba





- PC3 is an other low viscous formulation based on **CN925**. **SR454** complete the crosslinking. **SR285** give the adhesion:

PC3	
CN925	54%
SR454	22%
SR285	14%
CN386	4%
Benzophenone	2%
Irg 184*	4%

* : Supplied by Ciba

- PC4 is based on high thermal resistance epoxy acrylate **CN122A80**. Hardness and scratch resistance is given by **SR368**. Adhesion is provided by **SR238**

PC4	
CN122A80	22%
SR368	39%
SR238	32%
Darocure1173*	3%
Irgacure 184*	2%

* : Supplied by Ciba

The properties of each formulations is sum-up in the following graph:

