



THE SUBSTRATE GLASS FOR SCREEN PRINTING APPLICATIONS



There are a lot of possibilities to use glass; however the requirements this substrate and its various finishing types have to meet are also quite as diverse. Roughly, this market can be divided in two main groups:

GLASS SHEETS AND CONTAINERS

Typical fields of application for glass sheets are architecture and furniture industry. In Germany the production volume is approximately 1 million tons per year. Containers for this application are mainly packaging materials and other containers such as drinking glasses and bottles. Globally, in this industrial sector the largest market is Europe with a yearly volume of 20 million tons, Germany having the largest share. Glass products for the packaging industry are a huge industry and Germany has the highest recycling rate in Europe. Despite of the introduction of light PET bottles the market for glass packaging in Germany is quite stable. Glass is considered as a hygienic and safe packaging material. Beverages in PET bottles often have a content of acetaldehyde with a negative influence on the taste. Glass bottles therefore have a number of advantages compared to plastic bottles surpassing by far the image of "cheap plastic". Meantime glass is also considered to be a luxury good, being even more attractive if a decorative finish is applied.

Still ceramic inks are standard for glass container decoration. Although ceramic inks show superior resistances compared to organic inks they also have several severe disadvantages: the energy required for curing is extremely high, resulting in high production cost. In addition most ceramic inks contain a share of heavy metals and are therefore not considered to be ecological beneficial. There are also heavy-metal free ceramic inks, however not in many colour shades. Furthermore the inks will sinter into the substrate surface during oven curing, resulting in a colour change of the image. This is a special disadvantage when printing small numbers of articles as it is often necessary to carry out a time-consuming correction of the inks following the first printing trials.

Organic Inks for Glass Printing

In the furniture industry glass sheets have been successfully printed with mainly organic inks for a long period of time. Prints used indoors do not have to meet extreme requirements and required standards are easily met. However organic inks are increasingly used for container printing as many properties of organic glass inks are not necessary for every day use. If decorative prints do not have to be cut resistant (e.g. with a knife), they can easily be applied using organic printing inks. Contrary to the use of ceramic glass inks there is no bond due to sintering with the substrate and good adhesion can often be achieved by adding a second, mostly reactive component to the printing ink.

Organic Solvent-Based Inks

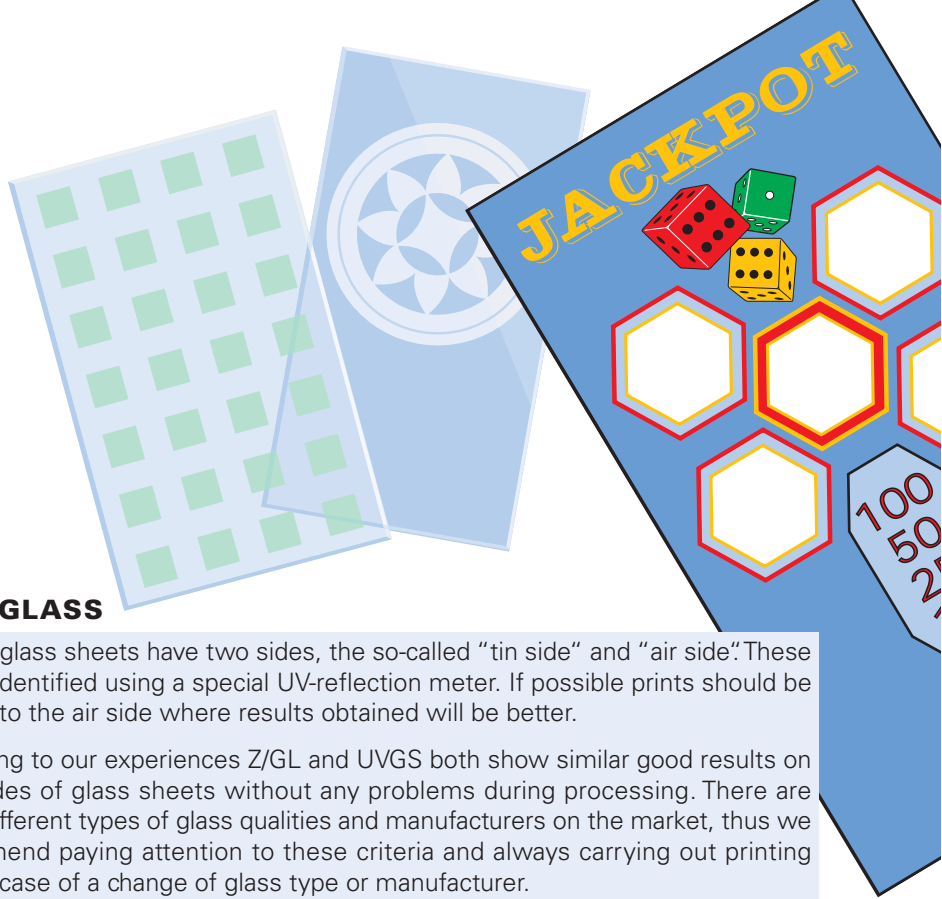
Coates Screen Inks GmbH has been offering Z/GL inks for years. This is a 2-component ink system with excellent resistances. Depending on requirements there are different processing methods, either air drying at room temperature or oven curing at 140°C. This curing temperature is far below that of ceramic inks, which require curing temperatures of approx. 600°C. In the case of organic inks, this higher temperature is required to achieve optimal cross-linkage of the binder, whereas ceramic inks will fuse with the surface. Ink range Z/GL shows good suitability for glass sheets, container glass and ceramic.

UV-curing glass inks also do belong to the group of organic glass inks.

These inks also are applied to the surface with good adhesion. Compared to solvent based inks they show the typical advantages of UV-inks, quick drying and speedy further processing. For printing of glass sheets we offer our UVGS ink system which can be printed without any additions if requirements are not too high. For increased resistance against water and condensed humidity we recommend addition of 5% adhesion promoter UVGS/HS. Contrary to other 2-component ink types UVGS mixed with hardener does not have a defined pot life and can, theoretically, be processed until the expiration date on the label. However, in order to achieve reproducible prints we recommend using up the mixed ink within a week.

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FLAT GLASS

Usually glass sheets have two sides, the so-called "tin side" and "air side". These can be identified using a special UV-reflection meter. If possible prints should be applied to the air side where results obtained will be better.

According to our experiences Z/GL and UVGS both show similar good results on both sides of glass sheets without any problems during processing. There are many different types of glass qualities and manufacturers on the market, thus we recommend paying attention to these criteria and always carrying out printing trials in case of a change of glass type or manufacturer.

CONTAINER GLASS

Usually glass bottles are cold-treated so that the glass surface is protected against friction. Prior to printing it is absolutely essential to carry out a flame pre-treatment to increase surface tension. Increased surface tension is necessary to achieve improved wetting and adhesion of the printing ink. Adhesion can be further promoted using UVitro® or Pyrosil® process. In this process silane is added to the gas, which generates a rough micro surface texture of SiOx on the glass surface, which acts as anchor points for the applied printing ink.

Silane flame treatment is a standard pre-treatment for drinking glasses. Usually two-component ink systems are used for drinking glasses in order to achieve the required resistances (e.g. dishwasher resistance). These ink types have a limited pot life. The adhesion promoters added contain highly reactive Silane compounds which allow a chemical bond of the pre-treated glass surface with the organic binders of the printing ink. Ink layers which adhere by mere adhesion will be infiltrated if immersed in water for longer periods, so that the printing ink can easily be removed. These systems are not suitable for drinking glasses and bottles.

Our classic UV-curing ink type UV/GL belongs to this category. This system shows excellent adhesion and scratch resistance on glass as long as the prints are not required to be water resistant.

Ink series UVGS is a universal ink type for a broad range of applications. In addition to the C-MIX-2000 colours especially mat etch imitation effect varnishes are required. UVGS is suitable for container glass if the applied prints do not have to be alcohol resistant. To meet the high requirements of the container glass industry we have now developed more optimised ink systems suitable for the processing conditions in this market segment.

Immediately prior to processing an adhesion promoter is added to these systems. To guarantee optimal processing these ink mixtures have to be processed within 8 hours.

Properties of cured ink systems depend on the whole process. In addition to the amount of UV energy used it will also play an important role whether the radiation is directed to the surface as bundled or focussed radiation or as a diffuse light.

In addition to our well-known UVGS ink, we now offer two additional ranges. Please contact me or our laboratory for further information and wet samples.

**GLASS PRINTING
BY SCREEN PROCESS**

