

Glow-in-the-dark

The decoration of products with screen-printed glow-in-the-dark effects

Screen
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Photoluminescent inks, so-called “glow-in-the-dark products“, contain inorganic phosphorescent pigments. When the printed ink film is exposed to artificial light or daylight, the pigments absorb the energy (electrons are lifted to a higher energy level). This absorbed energy is later emitted as visible light (electrons return to initial state).

This is the principle of phosphorescent inks and the basis of warning signs that are visible in the dark.

The pigment used is either an earth alkali aluminate with a long afterglow, or a zinc sulfite with a short afterglow effect.

The pigment choice will depend upon the application and the ink price.

Screen printing is used for glow-in-the-dark signs since the pigment size can be up to 60µm and the thickness of the printed ink layer is important for the afterglow quality.

No other printing process can keep up with the benefits screen printing has to offer for this application – including the large range of possible substrates.

This TechINFO provides background information on relevant Marabu products and their processing.

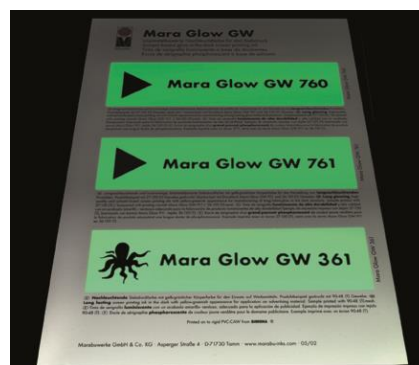
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1. Final products

1.1. General graphic applications

This includes for example greeting cards or stickers with a short afterglow (approx. 20 min.). Generally, there are no specified requirements in terms of the duration of afterglow for these products, but they must be inexpensive and easy to use. The pigments used have a low stability when exposed to UV light and they are sensitive to water, so they are not suited for outdoor use. The final product, therefore, usually requires a full-area transparent coating.



1.2. Long-term phosphorescent safety signage

These products must feature a longer afterglow period in order to comply with DIN 67510. The substrates, printing inks, and printing parameters must meet the DIN specifications, and the actual duration of the afterglow must be verified by the manufacturer of the safety sign in each individual case.

2. Glow-in-the-dark ink Mara®Glow GW

Marabu offers the following solvent-based standard products:



Short afterglow

Mara®Glow GW 361 – greenish colour

Mara®Glow GW 361 is suited to create eye-catching effects on stickers or signs for e. g. advertisement purposes.

Long afterglow

Mara®Glow GW 760 – whitish colour

Mara®Glow GW 761 – greenish colour

Correct processing and sufficient ink layers provided are these two products suited for the production of warning signs according to DIN 67510. Pigments must be charged completely, e.g. with a xenon light at 1000 lux for 20 min.

For other substrates (e.g. glass or metal) and/or desired hues (whitish or greenish), this effect can also be offered in other ink systems (UV-curable or 2K solvent-based) upon request.

3. Properties & processing

All three phosphorescent inks are free of phosphor and lead and free of radioactive materials.

Screen printing

The basis of the long-term phosphorescent ink is an extremely hard pigment with a very high specific gravity and high pigment content. The ink, therefore, must regularly be stirred homogeneously before printing and during production. The pigment content in the printed ink layer will otherwise be reduced and the phosphorescent duration required by DIN 67510 will not be met. Due to the hard pigments, the stencil abrasion during production is quite significant. We

recommend the use of a hard squeegee with rounded edges.

Mesh count recommendation & mileage

GW 361, mesh 27-55 to 48-55	approx. 8 sqm
GW 760, mesh 27-120	approx. 8 sqm
GW 761, mesh 27-120	approx. 8 sqm

These values relate to 1kg of printing ink plus addition of 5% thinner, and depend largely on the stencil thickness and the roundness of the squeegee edge.

Pad printing suitability

The colour shade Mara®Glow GW 760 also features limited suitability for pad printing. We recommend using a thick steel plate (10 mm). Recommended etch depth: 25 - 30 µm. Phosphorescent pigments are very hard and therefore have a very strong abrasive effect on the cliché, doctor blade, and ink cup. Common photopolymer clichés do not resist this strong abrasion and become unusable after a few prints.

Critical points:

- Risk of curling edges can be decreased with thicker substrates
- If the print is dried too fast and too warm, it may crack due to residual solvents

Opacity

To achieve a maximum phosphorescent effect, Mara®Glow should only be printed onto white substrates due to the low opacity of the ink.

Light storage saturation

All ink qualities produce a maximum storage when illuminated with 380-400 nm, wavelengths present in both daylight and neon light. If only incandescent lighting is available, even prolonged charging will result in only a reduced phosphorescent effect.

Phosphorescent duration

The phosphorescent quality GW 361 produces, if fully charged and properly processed, a phosphorescent effect of approx. 30 minutes.

The long-term phosphorescent quality GW 760 and GW 761 achieves and exceeds when properly processed, and provided that pigments are spread evenly, the values of DIN 67510 (20 mcd/m² after 10 min. / 2.8 mcd/m² after 60 min. - 340 min. until it drops to 0.3 mcd/m²), so that it glows for several hours.

The abbreviation mcd stands for millicandelas. It is the unit of luminance and is an indicator of the brightness of a light source or any luminescent object depending on the viewing angle. 1 cd (or 1000 mcd) corresponds approximately to the brightness of a candle.

4. Protective varnish & further processing

We recommend a protective overcoat with a suitable varnish as an additional protection against humidity. We recommend either the solvent-based varnish LIP 910 or the UV-curable Ultra *Graph* UVAR and Ultra *Pack* UVC varnishes.

For varnishing, we recommend the use of a mesh count similar or finer than the mesh used for printing.

If far above-average adherence and resistance is required, the addition of hardener H 1 may be helpful. Preliminary trials are essential!

For post-processing steps like cutting, stamping, folding, or grooving it is necessary to make sure that the ink film has completely dried. Owing to the amount of pigments and their nature, the ink film generally tends to be rather brittle. Preliminary trials are essential.

Especially thin substrates must be tested first if they show any signs of curling edges after printing.

5. Remarks

The advice in this TechINFO is based on our current knowledge. Nevertheless, before production start, the individual conditions (stencil, mesh, drying, post-processing, etc.) must be considered, tested and approved on site.

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