New seawater resistant labelstocks

Dr Rainer Rauberger, Kai Klimek

Water-based inkjet printing as an alternative to laser and thermal transfer printing for dangerous goods labels

The requirements for dangerous goods labelling are becoming more and more demanding and are forcing label manufacturers and the operators of filling and bottling plants to develop new solutions. Signage specifications include the new requirements from the GHS system, country-specific languages and legal requirements. Additionally, industrial customers are requesting greater flexibility when it comes to the implementation of labelling solutions. They are looking for ways of coping reliably with extremely small print runs and ad hoc needs without any major logistical effort, or would like to be able to customise colour designs for a perfect brand impact.

Figure 1: In international trade there is a growing demand for seawater resistant labelstocks and adhesives that comply with the stringent requirements of the BS 5609 standard

The traditional approach was to finish pre-printed labels using thermal transfer or laser printing techniques. In recent years, water-based inkjet printing has established itself alongside these methods and is preferred especially for rapidly changing small print runs and for labels with many different language combinations. The drawback up to now has been that there were very few seawater resistant materials suitable for water-based inkjet printing and the requirements were very difficult to fulfil with the existing printers on the market. Most conventional inkjet films were not able to pass the tests for resistance of water-based inks to long-term immersion in seawater and to abrasion of the inkjet coating after rolling in a mixture of sand and seawater.

New material complies with seawater resistance according to BS 5609

New possibilities are now opening up thanks to an innovative self-adhesive material developed by Germany-based company VPF GmbH & Co. KG. This material can be printed in colour with water-based pigment inks while simultaneously fulfilling the stringent seawater resistance requirements specified in the internationally acknowledged standard BS 5609. Beyond its standard portfolio of special self-adhesive materials, the manufacturer offers a complete mix-and-match range of seawater resistant facestocks and adhesives that can be combined at will. This line includes high-quality self-adhesive materials to suit any printing application, whether thermal transfer, laser or inkjet. In addition to the demanded seawater and abrasion resistance, they are also suitable for dispensing and adhesion to difficult substrates and are also available in increased coat weights (figure 1).

New legal requirements on dangerous goods labelling

The GHS system (Globally Harmonised System of Classification and Labelling of Chemicals) which came into force in the summer of 2015 brought major changes in the framework conditions for dangerous goods labelling. New hazard pictograms with red borders have replaced the old hazard symbols on orange backgrounds. This has made labelling more complex and also more costly. Conventional multistep label production processes using labels pre-printed with coloured hazard symbols for customisation – either by thermal transfer or laser printing – are now seldom possible because, according to the new regulations, the number of GHS pictograms on the label must be identical to the number of hazards declared for the product. It is no longer permissible for a label to have extra pictograms that are not applicable to the product or for it to carry empty pictogram fields. Nor is partial overprinting allowed (figure 2).

For operators of filling and bottling lines, the two-step labelling procedure therefore has to be designed so that precisely the right number of pictogram frames are pre-printed by conventional methods – which not only increases complexity in warehousing but can also lead to errors when post-printing labels. Digital printing technologies such as colour laser printing

or water-based inkjet printing are more affordable alternatives with which the required labels can be printed in-house and supplied to the production line just in time and in the right quantity.

Possibilities and limitations of in-house printing of GHS labels

There are three basic options for individual (post)printing of dangerous goods labels.

1. Barcode printers: Conventionally printed labels with coloured pictogram frames are post-printed by thermotransfer printing in black along with all order-related information such as article name or number, filling quantity, storage instructions and shelf-life data. A large number of pre-printed self-adhesive labels therefore has to be stocked so that the right GHS templates are available for each particular filling or bottling job. The risk of confusing these templates should not be underestimated: it is not unusual for the wrong template to be picked by accident when inserting the pre-printed rolls into the production line. Or that products cannot be filled and shipped because the right GHS-labels are out of stock.

2. Colour laser printer: Toner-based printing techniques allow just-in-time printing of the required GHS labels with all article-related hazard pictograms and statements as well as other information. However, laser printing harbours a disadvantage in the case of smaller label print runs. Because of the high heat input to the filmic self-adhesive material during thermal fixing of the toner, there is considerable material wastage at the beginning and end of the print run. This can be highly unprofitable if print orders change frequently.

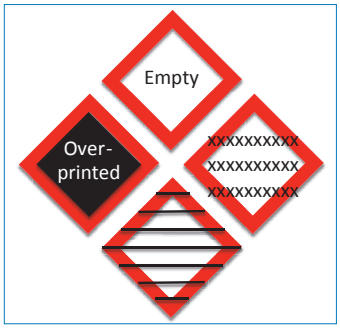

Figure 2: According to GHS specifications, pictogram frames must not be left empty or partially overprinted

3. Inkjet printers: As with colour laser printing, all the required product-specific GHS pictograms can be printed on the labels ad hoc and just in time for each order along with coloured logos, images and application illustrations to produce labels with an individual brand impact. Unlike toner-based methods, no thermal fixing is required. As a result, series of very small print runs can be produced very economically despite having to repeatedly start and stop the individual print jobs (table 1).

Certification for Epson, Kiaro and Primera inkjet printers

In-house colour printing of small and medium-size label print runs is thus becoming more and more interesting. Specifically for this application, VPF has introduced its new GHS-compliant labelstock Inkjet Special PP white, matt, 85 µm. Printed with pigment inks, the imprint is not only resistant to UV light and seawater but is also especially abrasion-resistant. The certification of the new self-adhesive material for seawater resistance according to Section 3 of the BS 5609 standard was performed with all common pigment inks used by the leading inkjet printer manufacturers. The label material used for approval was produced on the inkjet printers Kiaro D, Primera LX 2000 and Epson C3500, all of which were designed for use with pigment inks.

The new Inkjet Special PP self-adhesive material is also excellently suited for applications where seawater resistance or BS 5609 certification is not a main priority. These include any kind of labelling where high abrasion resistance is important, or labels for market gardening, laboratory or swimming pool supplies where resistance to water and cleaning agents is essential as well as good resistance to weathering during outdoor storage.

In comparison to conventional inkjet films, the seawater resistant Inkjet Special PP film from VPF also displays outstanding resistance to a large variety of industrial cleaners. The printing on the new film shows almost the same optical performance with respect to colour intensity, contrast and sharpness after eight washing cycles (at 45 to 65 °C) in a commercial washing station. Compared with this, a conventional inkjet PP film already showed distinct damage, with leaching and fading across the entire print face after only three washing cycles. Also the Inkjet Data PE film could not match this performance: After only five washing cycles, the inkjet coating began to come away, resulting in irreparable damage to the printed label (figure 3).

Technology	Facestocks with BS 5609 approval	Customised colour printing	Flexibility / suitable for small print runs
Thermal transfer and conventional printing	Data Special PE 95 µm, white, matt	No	Low
Laser printing	Laser PP white, matt, 100 µm	Yes	Medium
Water-based inkjet printing	Inkjet Special PP 85 µm, white, matt	Yes	High

Table 1: Printing technologies and labelstock materials for seawater resistant labels

Mix and match system with seawater resistant adhesives

It should be remembered that in addition to selecting seawater resistant printing materials, the dan-

Figure 3: Resistance of different inkjet films compared to an untreated reference sample

Requirements on seawater resistant self-adhesive labels according to BS 5609

For labelling of drums or similar transport containers destined for sea transports, seawater resistance to BS 5609 is often a mandatory requirement in international trade. The standard specifies that the affixed label should be capable of immersion in seawater for a period of three months without detachment of the label from the substrate and without the printing becoming illegible. Section 2 of the standard summarises the general requirements on the self-adhesive labelstock after immersion in seawater. Section 3 defines the test conditions that have to be met with respect to legibility and abrasion resistance of the printing (table 2).

Requirements on seawater resistant self-adhesive labels according to BS 5609	
Adhesive and self-adhesive material (section 2)	Printing and facestocks (section 3)
Peel adhesion after marine immersion for three months	Colour fastness: resistance to removal using adhesive tape
Peel adhesion after temperature cycling (7 days at 60 °C and 2 hours at 0 °C	Legibility and contrast: abrasion resistance after rolling in mixture of sand and seawater
Peel adhesion after temperature cycling (7 days at 60 °C and 2 hours at 0 °C)	Permanence of print: colour fastness and residual contrast after exposure to artificial salt spray and sunlight
Colour fastness after exposure to artificial salt spray and sunlight	

Table 2: Requirements of BS 5609 on seawater resistant labels

gerous goods label must satisfy all requirements of industrial applications. These labels have to be tested for resistance to three months' marine immersion and artificial weathering, which means that the adhesives used also have to stick reliably to the chemical drums, jerrycans and transport containers that are commonly used in practice. VPF has three modern adhesive technologies in its portfolio for this purpose. All of them are suitable for seawater resistant labelstocks and offer special performance profiles for label dispensing and customer specific end use requirements. They differ particularly in the specific kind of resistance they offer (either to solvents or cleaners, or for prolonged storage outdoors) and in their suitability for adhesion to rough or highly textured surfaces along with the increased adhesive coat weights needed for such applications (figure 4).

For less demanding applications on smooth surfaces where labels stick easily, the water-based Dispersion acrylate 922 is an excellent economical solution. In many cases, however, dangerous goods labels need to be affixed to highly textured and very rough surfaces, such as those of commercially available PE chemical drums and industrial bulk containers. Here, the aggressive tack of synthetic rubber hotmelts offers the advantage of instant adhesion and reliable bonding from the outset. The hotmelt adhesive HM 347 developed by VPF for this purpose is also ideal for all applications involving labelling of slightly moist or chilled surfaces. If desired, increased coating weights of up to 80 g/m² can be achieved with the hotmelt HM 347 grade. For all applications requiring very good temperature and media resistance, UV acrylate hotmelts are the best choice of technology. The VPF range includes the hotmelt HM 709 UV which can be used in coating weights up to 45 g/m². This adhesive, as well as the rubber-based hotmelt HM 347, is also approved for direct food contact (table 3).

Summary and outlook

In the past, printing of GHS labels was often done using thermal transfer and laser printing techniques. The newly developed and BS 5609 approved Inkjet Special PP film now makes it possible to use water-based inkjet printers for industrial colour printing of dangerous goods labels. Combined with the seawater resistant adhesive technologies based on dispersion, hotmelt and UV acrylate chemistries from the VPF portfolio, this opens up completely new opportunities for producing GHS labels with extremely high water and abrasion resistance by inkjet printing using pigment inks. This is particularly advantageous for small and medium-size bottling and filling orders with frequent variations in language combinations. As a specialist in coatings for self-adhesive materials that go beyond standard applications, VPF has added yet another forward-looking solution to its proven product portfolio for seawater resistant labelling materials and is thus expanding its position as a leading provider of inkjet printable self-adhesive labelstocks.

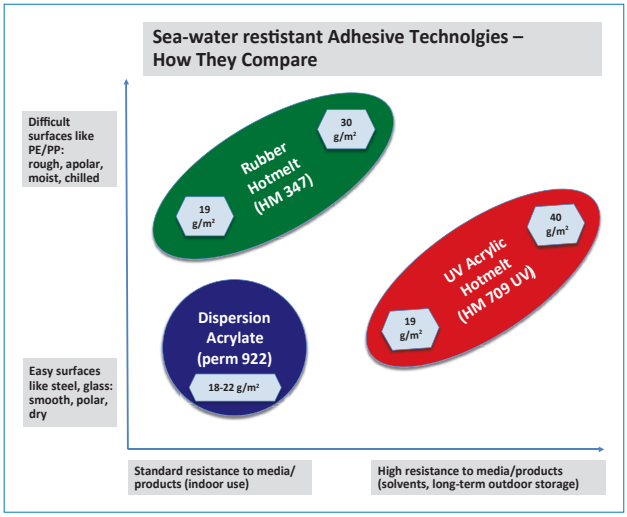

Figure 4: Seawater resistant adhesive technologies and their areas of application

Table 3: Seawater resistant adhesives technologies from VPF with specific application properties

Adhesive technology	Adhesive with BS 5609 approval	Coat weight (g/m²)	Media Resistance	Suitable for rough surfaces	Suitable for chilled / moist surfaces	Suitable for laser printing	High initial tack	Direct food contact	Cost
Dispersion acrylate	Permanent 922	18 – 22 g	o	–	–	+	–	No	+
UV acrylate hotmelt	HM 709 UV	19 – 45 g	+	o*	o	+	–	Yes	-
Synthetic rubber hotmelt	HM 347	19 – 80 g	–	+	+	–	+	Yes	o

** = with increased coat weight, 30 g/m² and up*

Imprint

Narrow WebTech

BPIF labels
Official media of the
British Printing Industries Federation
Labels Group
BPIF Northern Business Centre
Second Floor, Parkview House
Woodvale Road, Brighouse, HD6 4AB
United Kingdom
Phone +44-(0)1924-203338
Fax +44-(0)1484-710788
www.bpiflabels.org.uk
john.bambery@btconnect.com

Publishing House
G&K TechMedia GmbH
Denzlinger Straße 27
79312 Emmendingen · Germany
Phone +49-(0)76 41-9 57 86-0
Fax +49-(0)76 41-9 57 86-22
www.narrowwebtech.com
info@gk-techmedia.com

General Manager
Bernhard Niemela, Gerrit Klein

Advertisement Sales
Stefan Nolte
Phone +49-(0)76 41-9 57 86-17
nolte@gk-techmedia.com

Editor in Chief
Ansgar Wessendorf
wessendorf@gk-techmedia.com

Editorial management
Armin K. Geiger
geiger@gk-techmedia.com

Editor
Michael Scherhag
scherhag@gk-techmedia.com

Editorial office France
John Penhallow
penhallow@gk-techmedia.com

Editorial office Italy
Maria Laura Lombardi
lombardi@gk-techmedia.com

Editorial office Russia
Eugene Gerden
gerden@gk-techmedia.com

Editorial office United Kingdom
Tony R. White
white@gk-techmedia.com

ISSN No 1617-206X

G&K TechMedia GmbH also publishes:
- **Flexo & Gravure Global (in English)**
- **PackagingFilms (in English)**
- **Flexo+Tief-Druck (in German)**
- **Etiketten-Labels (in German)**
- **Die Besten der Besten (in German)**