



# Gravure

## The environmentally friendly print process

**Today it is essential for processes and products to be environmentally friendly. The customers demand it and environmental 'bad boys' could lose market share. And now the climate change, which could become an even more serious challenge for industry, is the top theme in the political debate. On 2 February 2007 the Intergovernmental Panel on Climate Change (IPCC) – a joint body of the United Nations Environment Programme and the World Meteorological Organisation – published a 'summary for policymakers' of their fourth Assessment Report. The media resonance was gigantic. The report points out the seriousness of the climate situation and asks for quick action. In the 20th century the earth warmed up 0,7 °C, and this process is accelerating. According to the IPCC, the temperature increase is now 0,2 °C per decade. The only escape to stop this process is to reduce carbon dioxide and other greenhouse gas emissions, and the first and most important measure should be the saving of energy which will affect industry.**

### How will the printing industry be affected?

In general the print process does not have a high carbon dioxide impact. The Carbon Trust, a company set up by the UK Government focused on finding carbon dioxide reduction solutions, published in November 2006 a document in which the carbon dioxide balance of the "Daily Mirror" was analysed. Only 10% of the carbon dioxide emissions arising come from the printing! And publication gravure does not just have a relatively low carbon dioxide impact: as the headline states, gravure is in general an environmentally friendly process. This is not a marketing-driven declaration: it can be proved by facts. An examination of the various process stages and operational controls shows that this claim is easily supported, as may be seen in the discussion below.

### Environmental Management Schemes

Nearly all European publication gravure printers run an Environmental Management Scheme, some according to the EMAS Directive, the others according to the ISO 14000 standard. The regular audits ensure that all relevant environmental aspects are monitored. Part of the scheme is the continuous improvement of the environmental performance. Many gravure printers run an Integrated Management System, in other words their Quality Management System, Environmental Management System, and maybe other Management Schemes e.g. Occupational Safety Management Systems, are combined. The standards which are reached by the gravure printers are very ambitious. Most of the printers regularly publish an environmental report where their constant environmental improvements can be followed.

### Gravure recycles as many substances as possible

The basis of the environmental friendliness of gravure printing is the principle to recycle as many substances as possible. The prime example is the solvent used in publication gravure: toluene. The system is so optimized that more than 95 % of the used solvent is recovered and reused. The recycling rate in new-build publication gravure plants is even higher than this value. Furthermore, the substance is reused at the same level and has the same quality as before, it is not downgraded. Another positive recycling aspect is that printed matter which is printed with toluene inks – which is only the case in publication rotogravure – can very easily be de-inked and recycled by the paper industry. It is clear that the recyclability of printed matter is the most important aspect of the paper chain.

### Cylinder preparation

But let's start with the cylinder preparation. In former times gravure cylinders were produced with photographic films and etching. This was a complex process which needed time, raw materials and energy and led to some chemical waste. These production steps are completely replaced by digital data handling. The final step of producing the cells in the surface of publication gravure printing cylinders is done either electromechanically by a Helio-Klischograph or else with a laser installation, etching is no longer necessary. The surface is then plated with a hard chromium layer to improve its wearing properties. Nowadays most gravure printers buy the necessary chromium compound in dissolved form, which means that the Health and Safety aspect is substantially optimized because the occurrence of dust is no longer possible. As a

sideline, the surface has a higher quality because continuous flow of the solution holds the concentration of the chromium ions during the galvanisation constant.

## Printing ink

The European publication rotogravure industry uses 180 000 tonnes of ink annually (2006). This consists of 30 kt pigments, 50 kt resins and 100 kt toluene. The toluene is to more than 95 % reused: this is possible because gravure uses a mono-solvent system. The formation of azeotropes (constant-boiling mixtures, which hinder purification) is not possible, so it is not necessary to distil the recovered solvent. This saves time, cost and energy. The recovered pure toluene can be reused on site or delivered back to the ink maker.

The toluene amounts which escape in the exhaust gas from the printing plant are very small. An EU Directive asks for a value below 82 mg per cubic metre of waste gas, which is more than complied with by all European rotogravure printers. Natural free radical chain processes in the atmosphere then break down this toluene: its atmospheric half-life is, according to the World Health Organisation (WHO), 12,8 hours.

Some toluene is lost as traces in the printed products. This amount has been significantly lowered in recent years. This was mainly achieved through modification of the ink composition. The surface of the printed ink takes slightly more time to solidify. In this short time period, around ten milliseconds, additional toluene evaporates in the printing unit and is caught by the recovery system. When the printed matter leaves the company the toluene traces are in any case below 0,04 %.

In consequence the airborne toluene concentration in private homes is far below 260 µg per cubic metre of air: this was confirmed by a study made in February 2007 by the Flemish research institute VITO. The figure of 260 µg/m<sup>3</sup> is the maximum limit accepted by the WHO for private homes. At the workplace, and already including a high safety margin, the maximum allowed concentration is 190 mg/m<sup>3</sup> as average over an eight-hour working day (EU Directive), which means that the WHO limit for private homes is 730 times more

diluted. The pigments in the gravure printing inks are synthetic, mostly based on petrochemicals. The European Printing Ink Makers Association established years ago an "Exclusion List for Printing Ink and Related Products" which excludes toxic and other very harmful materials as ingredients. The resins of the gravure inks based approximately 80 % on natural materials, for example rosin, gum rosin, tall oil resin. The last is a by-product of chemical pulp production in the paper industry.

## Paper

The paper industry has made extraordinary improvements during the last decades to reduce the environmental impact of the paper production. Years ago it seemed impossible that high quality publication gravure products could be printed on paper which contains recycled fibres. The European publication gravure paper manufacturers, which incidentally are all members of ERA, managed to develop such papers. Publication gravure papers which contain de-inked pulp (DIP), which means recycled fibres, are available on the market and used at customers' request.

At the same time it was possible to reduce the paper basis weight (grammage) without losing the optical properties. Paper production was advanced, for

example in Europe elemental chlorine bleaching was replaced by other more environmentally friendly oxidation methods. Water and energy consumption was reduced. The carbon dioxide balance improved through using renewable energy sources. The recycling rate for printed matter in Europe is 55 % (2005): if the European recovered paper which is recycled outside Europe is included, the rate reaches 63 % (2005).

## Gravure printing

The productivity of gravure printing is very high. Advanced presses can print on a 4,32 m wide paper web at speeds of up to 16 m/s. But even with smaller units, the energy used per square metre of printed product is less than in alternative printing methods. However this advantage increases the longer the print run. The saving of energy reduces the carbon dioxide emission which is one of the top themes today and in the future.

The main environmental advantages of publication gravure printing are:

- the use of easily recyclable raw materials,
- the usage of renewable raw materials,
- and last but not least, the production of a very easily recyclable product.

■ JB

**CO<sub>2</sub> emission in the production chain of a daily newspaper**

