New PCC based Specialty Pigment for Specific Use in Newsprint Paper

R. Schneider, B. Kübler, M. Laufmann,
Applied Technology Services
Business Unit Paper, Omya International AG, Schweiz
Content

- Graphical papers, current trends in newsprint
- Printing technology / inks for newsprint
- Good reasons for use of CaCO₃ in newsprint
- Print strike through / print show through
  - important influencing factors
  - impact of pigments on print through (Lab study)
- Omyasorb 8000 specialty pigment, commercial experience
- Summary / conclusion
Printing & Writing Paper Production 2009

“World”
~ 137 Million tons

Source: Pöyry Terminal

“Europe”
Mechanical
~ 22 Million tons

Quelle: CEPI

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Current trends in Newsprint, Europe

**Newsprint paper today**

- Mix of PM's with different production capacities

**Standard newsprint**

- wide, fast, new PM’s
- 100 % de-inked pulp
- located in densely populated areas
- lower basis weight
- increased print densities
- increased multi color printing

**Improved paper qualities**

- higher brightness
- higher opacity
- Heat-Set
- SC-C

**PM’s, large capacities**

**PM’s, average / smaller capacities**
Applied Printing Technologies for Newsprint

- Globally about $\frac{2}{3}$ of all publications are printed in offset

**Cold-Set (mostly applied)**
- Drying by absorption / diffusion
- Ink with low viscosity fractions

**Flexo print**
- Drying by evaporation
- Low viscosity inks

**Waterless offset printing**
- High viscosity inks, temperature
- High surface strength required

**Ink-Jet**
- Integrated ink jet
- Personalization
## Cold-Set Printing Ink Compositions

### Composition
- **Binders** (rosin, linseed oil, soja oil, starch and bee wax),
- **Fillers and color pigments**

### Purpose of binders
Coverage of ink pigments, to fix them onto the paper surface and to protect them from mechanical abrasion.

### Typical composition

<table>
<thead>
<tr>
<th></th>
<th>Heat-Set</th>
<th>Cold-Set</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>black</td>
</tr>
<tr>
<td>Pigments</td>
<td>12 – 20</td>
<td>20 – 25</td>
</tr>
<tr>
<td>Rosin</td>
<td>25 – 35</td>
<td>8 – 10</td>
</tr>
<tr>
<td>Vegetable oil</td>
<td>5 – 15</td>
<td>0 – 12</td>
</tr>
<tr>
<td>Mineral oil</td>
<td>25 – 40</td>
<td>~ 60</td>
</tr>
<tr>
<td>Additives</td>
<td>5 – 10</td>
<td>1 – 5</td>
</tr>
</tbody>
</table>

*Source: Printing Technology; H.Ullrich*
Cold Set Print Show / Strike Through Mechanism

- Cold-set ink pressed into paper surface

- Solid components (pigments and resin) remain on paper surface

- Low viscosity components (mineral and vegetable based oil) separate from the ink layer by diffusion, adsorb on fiber and pigment surfaces

- Excessive low viscosity components migrate (time depending) in direction paper back side, thereby increasing local transparency

- Specialty pigments and / or higher proportions of regular fillers offer additional absorption potential in order to immobilize the excessive low viscosity portions
Print show through
Image, which is visible through a sheet of unprinted paper covering a printed surface. Print show through strongly influenced by sheet opacity.

Print strike through
Diffusion of low viscosity fractions into the sheet towards the sheet back side (f time).

Show through / strike through = print through
Print strike / show through - Important influencing Factors

- Flocculation, Formation, Retention, Filler distribution
  - Sheet formation

- Optical properties
  - Opacity, Brightness

- Basis weight

- Sheet internal – and surface structure
  - Smoothness, Porosity
  - Pore size distribution

- DIP, HS, TMP, Quality
  - Fiber source

- Printing
  - Ink volume,
  - Ink composition,
  - Lay-out

- Paper machine
  - Clothing, Drainage,
  - Machine lay-out
Print strike / show through - Influence of Pigments

Primary, Secondary, Specialty Pigments

Opacity, Surface, Porosity, Pore structure, Absorption potential
Advantages of CaCO$_3$ as Primary Filler in Newsprint

- Increased brightness and opacity
- Improved smoothness (PCC)
- Improved ink absorption = less smearing
- **Reduced print strike / show through**
- Reduction of paper quality fluctuations due to DIP related pigment loading variations
- Cost reduction (Fiber replacement, bleaching, drying)
- **Current pigment loading in newsprint paper 2 - 20 (24) %**
  Primary filler addition in DIP containing newsprint 0 - 7 %

- **Secondary pigment: ex DIP**
  Primary fillers: CaCO$_3$ (Chalk, GCC, PCC) Clay
  Specialty pigments: Mg Al Silicate, calcined clay, Omyasorb
Influence of Pigments on Print strike / show through

**Basis weight:** 42.5 g/m²

**Fiber furnish:** 100 % DIP

**Pigment loading:**
- **Secondary ex DIP**
  - 13.4 %  (5.3 % CaCO₃ / 8.1 % Clay)

**Primary filler:**
- 2 und 4 (8) %

**Retention aid:** 0.04 % PAM

**Wet press applied:** 0.42 MPa

**Surface roughness:** 4 PPS
# Pigment Data

<table>
<thead>
<tr>
<th></th>
<th>Hydrocarb 60</th>
<th>Omyasorb 7600</th>
<th>Omyasorb 8000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spec. surface area</td>
<td>$m^2/g$</td>
<td>7</td>
<td>50</td>
</tr>
<tr>
<td>Sedigraph 5120</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 2 µm</td>
<td>%</td>
<td>62</td>
<td>66</td>
</tr>
<tr>
<td>&lt; 1 µm</td>
<td>%</td>
<td>38</td>
<td>37</td>
</tr>
<tr>
<td>MTD $d_{50}$</td>
<td>µm</td>
<td>1.45</td>
<td>1.40</td>
</tr>
<tr>
<td>Brightness R-457</td>
<td>%</td>
<td>95.0</td>
<td>94.6</td>
</tr>
<tr>
<td>Solids</td>
<td>%</td>
<td>75</td>
<td>40</td>
</tr>
<tr>
<td>Viscosity Brookfield</td>
<td>$mPas$</td>
<td>120</td>
<td>560</td>
</tr>
<tr>
<td>Total Intr. Hg Vol.</td>
<td>$cm^3/g$</td>
<td>0.16</td>
<td>0.74</td>
</tr>
<tr>
<td>Oil Absorption</td>
<td>g/100 g</td>
<td>~ 20</td>
<td>~ 55</td>
</tr>
</tbody>
</table>

*MTD = Mittlerer Teilchendurchmesser*
Pigment pore size distribution (Mercury Porosimetry)

Pore volume \([\frac{dV}{d(\log d)}]\) / cm³/g⁻¹

- Hydrocarb 60
- Omyasorb 7600
- Omyasorb 8000

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Pigment Morphologies
Opacity at 42.5 g/m²

Lab study

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Lab study

Brightness R-457

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Roughness PPS (1.0 soft)

<table>
<thead>
<tr>
<th></th>
<th>without primary filler</th>
<th>2% Hydrocarb 60</th>
<th>4% Hydrocarb 60</th>
<th>2% Omyasorb 7600</th>
<th>4% Omyasorb 7600</th>
<th>2% Omyasorb 8000</th>
<th>4% Omyasorb 8000</th>
</tr>
</thead>
<tbody>
<tr>
<td>µm</td>
<td>6.0</td>
<td>5.5</td>
<td>5.0</td>
<td>5.5</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
</tr>
</tbody>
</table>

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Print strike through / show through

% Strike through / show through (24 h)

Without primary filler

GCC HCB 60
OSO 7600
OSO 8000

% Primary filler

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Omyasorb 8000 in Newsprint, Commercial Experience

**Production:**
> 40 tons/h

**Basis weight:**
42.5 – 45.0 g/m²

**Fiber furnish:**
100 % DIP, 18 % Pigment ex DIP

**Specialty pigment:** (~ 1 %)
Mg Al Silicate
Omyasorb 8000

**Retention system:**
Polyamine / PAM

**Other additives:**
ATC / cationic starch

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# Pigment data (Commercial trial)

<table>
<thead>
<tr>
<th>Spec. Surface area</th>
<th>Mg Al Silicate</th>
<th>Omyasorb 8000</th>
</tr>
</thead>
<tbody>
<tr>
<td>m²/g</td>
<td>73</td>
<td>58</td>
</tr>
</tbody>
</table>

**Sedigraph 5120**

| < 2 µm | %   | 82   | 67   |
| < 1 µm | %   | 63   | 32   |
| aps d₅₀ | µm | 0.70 | 1.48 |

**Brightness R-457**

| %   | 97.0 | 96.5 |

**Solids**

| %   | 30.0 | 35.5 |

**Viscosity Brookfield**

| mPas | 60   | 190  |

**Tot. Intr. Hg Vol.**

| cm³/g | 1.22  | 1.24 |

**Oil absorption**

| g/100 g | ~ 89  | ~ 84 |

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Mg Al Silicate and Omyasorb 8000 (5000 x)

Mg Al Silicate

Omyasorb 8000

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Results, Commercial trial with Omyasorb 8000

- **Brightness R-457 - UV (%)**
- **Opacity (%)**
- **Density (back side, 6 h)**
- **Density (back side, 24 h)**
- **Print through (%)**
  - Without Mg Al Silicate
  - Omyasorb 8000

- **Specialty Pigment addition (%)**
  - 0%
  - 5%
  - 10%
  - 15%

- **Secondary pigment ex DIP (%)**
  - 0.1%
  - 0.2%
  - 0.3%

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Summary: Commercial Trail with Omyasorb 8000

- **Basis weight**
  42.5 g/m²

- **„Wet end“ System / Runnability**
  unchanged good

- **Brightness / Opacity**
  slightly increased like with Mg Al Silicate

- **Short period trial**
  **Strike through / show through**
  similar reduction like with Mg Al Silicate

- **Longer period trial**
  confirmed promising results of short trial

- **Economical consideration**
  Saving potential: ca. 1.7 Euro/ton paper
Summary / Conclusion

- Current trends in newsprint (Europe)
- Print through / important influencing factors
- Omyasorb 8000 = newly developed specialty pigment based on PCC
  - High specific surface area
  - Particular pore size distribution
  - High absorption capacity
- Omyasorb 8000 application
  - Increased brightness and opacity
  - Significantly reduced print through
  - Simple and safe application
  - Potential saving vs other specialty pigments

Omyasorb = new specialty pigment for newsprint (standard / improved) and other low basis weight graphical papers
Do You Have Any Questions