E AS IN EFFICIENCY – VINNOL® SURFACE COATING RESINS FOR PRINTING INKS
HOW DO YOU ADD GLOSS TO EFFICIENCY?

The formulation of printing inks is complex – and has a long tradition with WACKER. As a leading chemical company, we have been optimizing our portfolio of binders and additives since the 1950s. Today, formulators worldwide rely on VINNOL® and our services which are offered to you at over 100 subsidiaries in all key regions of the world.
Depending on the specific application and processing technology, printing inks must fulfill various requirements. Among the most important characteristics are viscosity, gloss and – of course – cost effectiveness. The VINNOL® resin portfolio enables you to adjust application and process requirements extraordinarily well.

**Key Advantages of VINNOL®**
- High toughness and permanent flexibility
- Superior abrasion resistance
- Outstanding water and chemical resistance
- Inherent flame retardance
- Excellent solubility and ease of processing
- Wide formulation range
- Low odor and taste-free

**Range of Applications**
VINNOL® binders are suitable for a variety of applications, e.g.:
- Gravure inks
- Inkjet inks
- Screen-printing inks
- Transfer printing inks
- Overprint varnishes

**Typical Product Requirements for Printing Inks:**
- High gloss
- Superior color development
- Resistance to typical packaging contents
- Adhesion to various substrates
- Low VOC content
- Light fastness
- Strong hiding power
- Raw-material quality consistency

**Typical Process Requirements for Printing Inks:**
- Short dispersion times
- High resin solubility
- Wide range of compatibility with pigments and other raw materials

**A Unique Combination of Gloss and Efficiency for Pigmented Systems**
WACKER offers unique emulsion polymerized vinyl chloride co- and terpolymers to the printing ink industry. These VINNOL® E grades provide the following advantages for high-quality and cost-efficient printing inks:
- Exceptional gloss and color development
- Low gel-forming tendency
- Very good overprintability
- Excellent compatibility with other formulation components
- Short pigment dispersion times
- Reduced usage of dispersion additives and pigments

**Suitable for Food Packaging**
Many VINNOL® resin grades can be used for applications compliant with FDA 21 CFR 175.300 as well as European Food Contact Regulations.

VINNOL® is a registered trademark of Wacker Chemie AG.
VINNOL® is WACKER’s brandname for vinyl chloride co- and terpolymers. All grades are compatible with each other, creating a modular system for adjusting the characteristics of printing inks.

VINNOL® without Functional Groups
VINNOL® copolymers without functional groups are available in different molar compositions and molecular weights. They adhere strongly to a wide variety of substrates, especially to plastics and films of polar character.

VINNOL® Surface Coating Resins with Carboxyl Groups
VINNOL® surface coating resins with carboxyl groups are terpolymers of vinyl chloride, vinyl acetate and dicarboxylic acids. These grades can be identified by an “M” in the product name. They provide excellent adhesion, particularly to metal substrates. Adhesion to mineral substrates is also enhanced.

VINNOL® Surface Coating Resins with Hydroxyl Groups
VINNOL® resins with hydroxyl groups are available in two different product types. VINNOL® E/A grades are copolymers and terpolymers of vinyl chloride, hydroxy acrylate and, in the case of VINNOL® E 22/48 A, dicarboxylic acid ester. The other product type, VINNOL® H 5/50 A, is a terpolymer of vinyl chloride, vinyl acetate and vinyl alcohol.

VINNOL® Functional Grades: M Types
VINNOL® functional grades are terpolymers of vinyl chloride, vinyl acetate and dicarboxylic acids. These grades can be identified by an “M” in the product name. They provide excellent adhesion, particularly to metal and plastic sheeting, we offer VINNOL® grades of higher molecular weights.

Polymerization Technologies
Only WACKER offers poly-vinyl-chloride-based surface coating resins produced in two different polymerization processes: suspension and emulsion polymerization.

VINNOL® H Grades
VINNOL® H grades are produced via a suspension polymerization process, allowing you to formulate highly transparent coatings.

VINNOL® E Grades
VINNOL® E grades are produced via an emulsion polymerization process. Due to their excellent pigment-wetting and short dispersion times, they are particularly suitable for printing inks.

How to Read the Product Names

VINNOL® E 15/45 M
Vinyl Acetate Content: A higher vinyl acetate content reduces solution viscosity and the coating-softening range while increasing coating flexibility.
Polymerization Process: H = Suspension polymerization
Polymerization Process: E = Emulsion polymerization
K Value:
Molecular weight / viscosity. A higher K value increases solution viscosity, mechanical strength and the coating-softening range.

Vinyl Chloride Vinyl Acetate

DICARBOXYLIC ACID

Hydroxy Acrylate

1 Vinyl Alcohol

2 Hydroxy Acrylate

Vinyl Alcohol

How to Read the Product Names

VINNOL® Non-Functional Grades

VINNOL® Functional Grades: M Types

VINNOL® Functional Grades: A Types

VINNOL® Functional Grades: A Types"
WITH AN INTELLIGENT SYSTEM

Grades without Functional Groups

Production of mill base

- Excellent pigment wetting
- Shorter pigment dispersion time
- Better hiding power

- VINNOL® E 15/45

Production of varnish

- Very low viscosity
- Low viscosity
- Intermediate viscosity

- VINNOL® H 14/36
- VINNOL® H 15/42
- VINNOL® H 15/50
WITH A UNIQUE PORTFOLIO

Product Overview: Printing Inks

<table>
<thead>
<tr>
<th>Polymer Composition</th>
<th>Grades</th>
<th>Vinyl chloride % by wt</th>
<th>Vinyl acetate % by wt</th>
<th>Other monomers % by wt</th>
<th>K value</th>
<th>Glass transition temperature Tg (DSC) °C</th>
<th>Viscosity1 DIN 53015 [mPa-s]</th>
<th>FDA Regulation</th>
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<tbody>
<tr>
<td>With Carboxyl Groups</td>
<td>VINNOL® E 15/45 M</td>
<td>84.0 ± 1.0</td>
<td>15.0 ± 1.0</td>
<td>ca. 1.0</td>
<td>45 ± 1</td>
<td>ca. 73</td>
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<td>VINNOL® E 15/45 H</td>
<td>VINNOL® H 15/45 M</td>
<td>84.0 ± 1.0</td>
<td>15.0 ± 1.0</td>
<td>ca. 1.0</td>
<td>48 ± 1</td>
<td>ca. 74</td>
<td>60 ± 10</td>
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<td>VINNOL® E 30/48 M</td>
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<td>70.0 ± 1.0</td>
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<td>ca. 65</td>
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<td>84.0 ± 1.0</td>
<td>-</td>
<td>ca. 16.0*</td>
<td>39 ± 1</td>
<td>ca. 69</td>
<td>20 ± 5</td>
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<td>VINNOL® E 15/48 A</td>
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<td>83.5 ± 1.0</td>
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<td>VINNOL® E 22/48 A</td>
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<td>-</td>
<td>ca. 25.0**</td>
<td>48 ± 1</td>
<td>ca. 61</td>
<td>45 ± 7</td>
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<td>VINNOL® H 5/60 A</td>
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<td>90.0 ± 1.5</td>
<td>4.0 ± 1.0</td>
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<td>51 ± 1</td>
<td>ca. 76</td>
<td>100 ± 20</td>
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<td>Without Functional Groups</td>
<td>VINNOL® E 15/45</td>
<td>85.0 ± 1.0</td>
<td>15.0 ± 1.0</td>
<td>-</td>
<td>45 ± 1</td>
<td>ca. 75</td>
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<td>85.6 ± 1.0</td>
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<td>15.0 ± 1.0</td>
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<td>VINNOL® H 40/50</td>
<td>VINNOL® H 40/50</td>
<td>63.0 ± 1.0</td>
<td>37.0 ± 1.0</td>
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<td>50 ± 1</td>
<td>ca. 60</td>
<td>55 ± 10</td>
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</table>

1 20% solution in methyl ethyl ketone, dissolved at 50 °C
2 WACKER method
3 EN ISO 1628-2
4 Hydroxy acrylate
5 Dicarboxylic ester
6 Vinyl alcohol

Balancing Gloss and Viscosity by Combining VINNOL® E and VINNOL® H Grades

<table>
<thead>
<tr>
<th>Test</th>
<th>Milling medium (mill base)</th>
<th>Diluting medium (varnish)</th>
<th>Gloss</th>
<th>Gloss evaluation</th>
<th>Impact on viscosity after dilution</th>
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<tr>
<td>1</td>
<td>VINNOL® H 15/50</td>
<td>VINNOL® H 15/50</td>
<td>7</td>
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<td>0</td>
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<tr>
<td>2</td>
<td>VINNOL® E 15/45</td>
<td>VINNOL® E 15/45</td>
<td>53</td>
<td>+++</td>
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<tr>
<td>3</td>
<td>VINNOL® E 15/45</td>
<td>VINNOL® H 15/50</td>
<td>52</td>
<td>++</td>
<td>++</td>
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<tr>
<td>4</td>
<td>VINNOL® E 15/45</td>
<td>VINNOL® H 14/36</td>
<td>53</td>
<td>+++</td>
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<tr>
<td>5</td>
<td>VINNOL® E 15/45</td>
<td>VINNOL® H 15/42</td>
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<td>6</td>
<td>VINNOL® E 15/45</td>
<td>VINNOL® H 40/50</td>
<td>48</td>
<td>++</td>
<td>+</td>
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</tbody>
</table>

Find The Perfect Mix

Especially attractive is the combination of VINNOL® E and VINNOL® H grades due to their high compatibility. VINNOL® E grades boost pigment performance and provide higher gloss. VINNOL® H grades of various K values may be used to fine-tune printing ink viscosity.

Any Questions?
Benefit From Our Extensive Services

WACKER experts worldwide help you select the right VINNOL® grade and support you in optimizing your formulations. Spanning the globe with five business divisions, operating 25 production sites, WACKER is currently active in over 100 countries. WACKER maintains subsidiaries and sales offices in 29 countries across Europe, the Americas and Asia—including a solidly established presence in China. With a workforce of 17,200, WACKER sees itself as a reliable innovation partner that develops trailblazing solutions for, and in collaboration with, its customers. WACKER also helps them boost their own success. WACKER’s technical centers employ local specialists who assist customers worldwide in the development of products tailored to regional demands, supporting them during every stage of their complex production processes, if required.

Please contact us!
www.wacker.com/vinnol
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