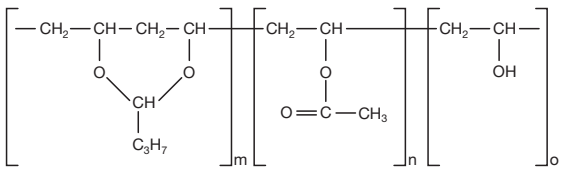
PIOLOFORM® PRODUCT OVERVIEW

WACKER markets polyvinyl butyrals under the trade name PIOLOFORM®.

Structural formula of PIOLOFORM®



Polyvinyl butyrals are a special type of polyvinyl acetals that are generally produced in a three-step process.

First, vinyl acetate is polymerized to polyvinyl acetate. Second, this is saponified to polyvinyl alcohol. Third, an aqueous solution of the polyvinyl alcohol is reacted with an aldehyde, in the presence of acidic catalysts, into a polyvinyl acetal. In the case of polyvinyl butyrals, butyraldehyde is used.

Neither saponification to polyvinyl alcohol nor reaction with butyraldehyde goes to completion. For this reason, all PIOLOFORM® grades contain – in addition to the butyral groups – a certain amount of hydroxyl groups and a small fraction of acetate groups.

The physical and chemical properties of polyvinyl butyrals vary with the degree of polymerization and the content of butyral, acetate and hydroxyl groups.

As the molecular weight (degree of polymerization) rises, the solution viscosity of the polyvinyl butyral increases, if the polymer composition remains unchanged. In addition, the toughness and the softening range also increase as molecular weight increases.

The ability of polyvinyl butyral films to absorb (and release) water, a property conferred by the free hydroxyl groups, decreases as the content of vinyl alcohol decreases (i.e., degree of acetalization increases) and films become correspondingly more water resistant.

The content of hydroxyl groups also influences the film's solubility in organic solvents. Thus, only polyvinyl butyrals containing less than 20 % by weight vinyl alcohol dissolve in ethyl acetate to form clear solutions. At higher vinyl alcohol contents (lower degree of acetalization), the solubility of the PVBs decreases markedly.

On the other hand, reducing the vinyl alcohol content to below 15 % by weight will even reduce the PVBs' solubility in the lower alcohols; the compounds instead become soluble in aromatic solvents. Compatibility with other binders is markedly influenced by the vinyl alcohol content in an analogous fashion.

For statistical reasons, the theoretical upper limit for the acetalization reaction of polyvinyl alcohols is 81.6 mol %. Consequently, polyvinyl butyrals always contain at least 7 % by weight residual vinyl alcohol units.

It is standard practice to use polyvinyl butyrals with vinyl alcohol contents of 9 to approx. 30 % by weight.

WACKER POLYMERS

PIOLOFORM® PRODUCT OVERVIEW

Grades	Vinyl alcohol % by wt[1]	Vinyl acetate % by wt[1]	Vinyl acetal % by wt	Viscosity[2] DIN 53015 [mPa·s]
BN 18	18.0 ± 1.5	2.0 ± 1.0	~ 80	16.5 ± 1.5
BL 18	18.0 ± 1.5	2.0 ± 1.0	~ 80	24.5 ± 1.5
BR 18	18.0 ± 1.5	2.0 ± 1.0	~ 80	40 ± 5
BM 18	18.5 ± 1.5	2.0 ± 1.0	~ 80	72 ± 13
BT 18	19.0 ± 1.5	2.0 ± 1.0	~ 79	210 ± 50
BS 18	18.0 ± 1.5	2.0 ± 1.0	~ 80	625 ± 125[3]
BL 16	16.0 ± 1.5	2.0 ± 1.0	~ 82	24.5 ± 1.5

1) WACKER method
2) 10 % by wt solution in ethanol (94 %)
3) 10 % by wt solution in ethyl acetate/methanol 1/3 vol %
4) ISO 2431, 6 mm cup
5) DIN 53211, 6 mm cup
6) Method: SEC (Size Exclusion Chromatography)
Solvent: THF
Standard: Polystyrene
7) The information contained is for guideline only. We make no warranty as to the accuracy of these data and they should not be interpreted as a specification.

PIOLOFORM®	BN 18	BL 18	BR 18
Application areas			
Adhesives			
Printed circuit board adhesives			
Industrial coatings			
Anti-corrosion primers	●	●	●
Plastic coatings	●	●	●
Stoving enamels	●	●	●
Wood varnishes	●	●	●
Masonry paints			
Sealers			○
Packaging coatings			
Barrier coatings			○
Can coatings	●	●	●
Heat-sealable coatings	●	●	●
Heat-seal-resistant coatings	●	●	●
Primers for metallization	●	●	●
Protective coatings for metallized film	●	●	●
Pigment preparations			
Chips	●	●	
Pastes	●	●	
Printing Inks			
Flexographic printing	●	●	●
Gravure printing	●	●	●
Ink-jet printing	●	○	
Screen printing	○	○	●
Transfer printing	●	●	●
Temporary binders			
High-tech ceramics			○
Powder injection molding	●	○	

● = Recommended ○ = Suitable

Efflux time ISO 2431 4-mm cup[2,7]	Molecular weight M_w (SEC)[6,7]	Glass transition temperature T_g[7] (DSC) °C	Monomers in section A of EU Directive 2002/72/EG	FDA regulation § 175.300
~ 22	30–35 x 10^3	~ 66	yes	yes
~ 26	35–45 x 10^3	~ 67	yes	yes
~ 33	50–60 x 10^3	~ 69	yes	yes
~ 61	70–90 x 10^3	~ 70	yes	yes
~ 150	90–120 x 10^3	~ 70	yes	yes
~ 210[4]/70[5]	250–350 x 10^3	~ 72	yes	yes
~ 25	35–45 x 10^3	~ 84	yes	no

BM 18	BT 18	BS 18	BL 16
○	○	○	
●	●		
●	○		●
●	●	●	●
○			●
●	●	●	
●	●	●	
○			●
●	●		
●	○		●
●	○		●
			●
			○
			○
○			●
○			●
			○
●	●	○	○
●	●		●
●	●		
			○

WACKER POLYMERS

The data presented in this technical data sheet are in accordance with the present state of our knowledge, but do not absolve the user from carefully checking all supplies immediately upon receipt. We reserve the right to alter product constants within the scope of technical progress or new developments. The information given in this technical data sheet should be checked by preliminary trials because of conditions during processing over which we have no control, especially where other companies' raw materials are also being used. The information provided by us does not absolve the user from the obligation of investigating the possibility of infringement of third parties' rights and, if necessary, clarifying the position. Recommendations for use do not constitute a warranty, either express or implied, of the fitness or suitability of the product for a particular purpose.

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