For decades, Borchers associative thickeners, under the trade name **Borchi® Gel,** have been known for their quality and purity. In the field of architectural, decorative and industrial coatings, they are among the most common products in the market.

In response to tightening environmental regulations, OMG Borchers has developed a new series of associative based thickeners. The new products are free of ingredients like APEO based emulsifiers, VOC diluents and tin compounds. Therefore, the new products comply with the Decopaint Directive that is valid from 2007.

Borchi® Gel 0434

VOC-free, tin free, APE free

associative HEUR-thickener
for waterborne coatings

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Borchi® Gel – associative thickeners

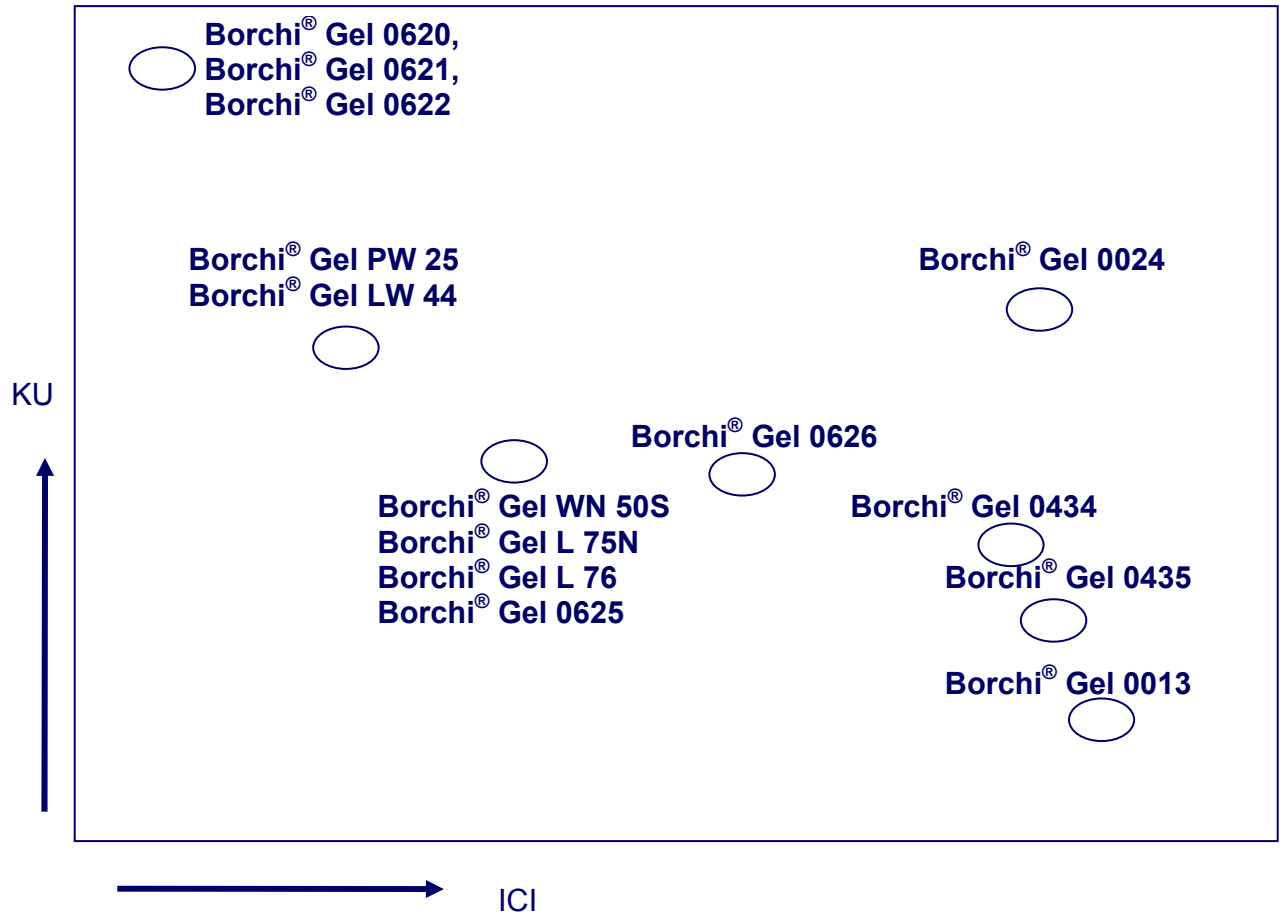
Product overview

The major feature of associative thickeners, and the main distinction to other types of thickeners, is the ability to form a non-covalent network with paint ingredients. Weak bonds are formed with pigments, solid particles of the resin binder, fillers and extenders.

An optimum viscosity in the liquid phase, measured under higher shear force (ICI), is critical for the final paint characteristics. It results in good film build, hiding power, spatter resistance and brush drag. When applied using industrial spraying methods, rheological additives provide excellent leveling while minimizing sag tendency.

Picture 1 illustrates the different Borchi® Gel associative thickeners classified by their rheological efficacy in waterbased systems. The Y-axis represents increasing Krebs Stormer viscosity [KU] of the HEUR thickener, while the X-axis represents increasing ICI viscosity.

Picture 1: Borchi® Gel – rheological profiles



Borchi® Gel 0434 can be combined with all common thickener types including cellulosics, HASE and inorganic thickeners. The right choice is dependent on the paint ingredients, primarily the type of resin binder used. Each combination has to be tested prior to use.

Borchi® Gel 0434

Free of solvents, APEO and tin compounds

Characteristic

Borchi® Gel 0434 is a novel HEUR thickener produced without ingredients like VOC solvents, APEO and tin compounds. It is therefore suitable for the rheological adjustment of waterborne pigmented and clearcoats where environmental issues are of prime importance. Borchi® Gel 0434 also works well as a thickening agent in adhesives, leather compounds and printing inks. Borchi® Gel 0434 imparts a Newtonian profile with enhanced viscosity stabilization at higher shear demands.

Characteristic data

Active Substance:	20 %	
Solvent	water	
Appearance	whitish, opal liquid	
VOC amount in g/l	according to EU-directive 1999/13/EG (EU)	0
	according to EPA method 24 (US)	0

Application property

Borchi® Gel 0434 forms a non-covalent network with other paint components and stabilizes the viscosity in high shear applications. The product exhibits Newtonian flow behavior, which results in excellent application properties with respect to brushing and rolling. Borchi® Gel 0434 is highly efficient in nearly all waterborne resin binders including latexes with small particle size. Borchi® Gel 0434 also provides stability, gloss and leveling properties.

To achieve desired viscosity at lower shear force, Borchi® Gel 0434 can be combined with all common types of thickening agents based on cellulose, polyacrylic (HASE) and polyurethane (HEUR). Borchi® Gel 0434 incorporates easily into the coating and can also be used as a post addition.

Borchi® Gel 0434 suppresses syneresis and separation in unstable systems. In pigmented systems, Borchi® Gel 0434 increases color development and distribution of tint pastes.

Borchi® Gel 0434 can be added during any production step. A pre-dilution is not necessary.

Efficiency

Each paint ingredient generates interactions with other components that directly influence the final rheological profile. Therefore, a direct comparison to specific results in a ready made paint formulation is not recommended.

Table 1: Efficacy and possible combination opportunities of Borchi® Gel 0434 in different resin binder basis

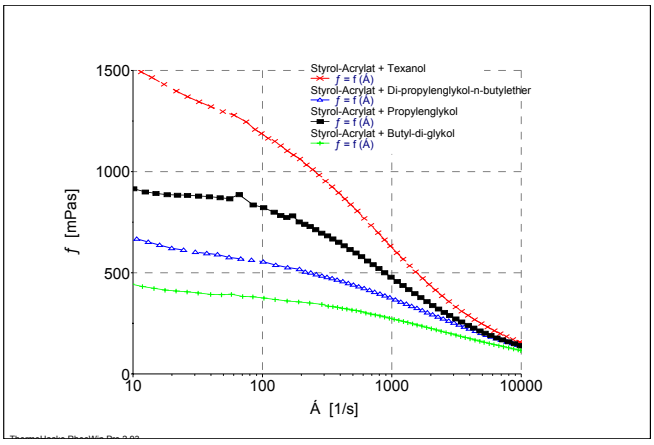
resin binder basis	influence on rest viscosity (Brookfield, KU)	influence on high shear viscosity (ICI)	possible thickener combination
styrene –acrylate	m	s	Borchi® Gel PW 25
ethylene-vinyl-acetate	w	s	Borchi® Gel PW 25
polyurethane	m	m	Borchi® Gel 0622
vinyl-acrylate	w	s	Borchi® Gel LW 44
straight acrylate	s	s	Borchi® Gel PW 25
acrylate-copolymer	s	s	Borchi® Gel 0621

s: strong m: medium w: weak

In many cases coalescent agents, as well as surface active agents, have an effect on the associative structure in the paint. As a result, a decrease of viscosity in low shear range is obtained. This influence has to be considered when these kinds of components are incorporated.

Picture 2: The influence of various coalescent agents on the rheological profile in a styrene acrylate polymeric dispersion

Rheo Stress RS 1, Haake with Borchi® Gel 0434



By changing the coalescence agents, the viscosity can be easily adjusted depending on the required paint performance.

Styrene--Acrylate + **texanol**

Styrene -Acrylate + **di-propylene glycol-n-butylether**

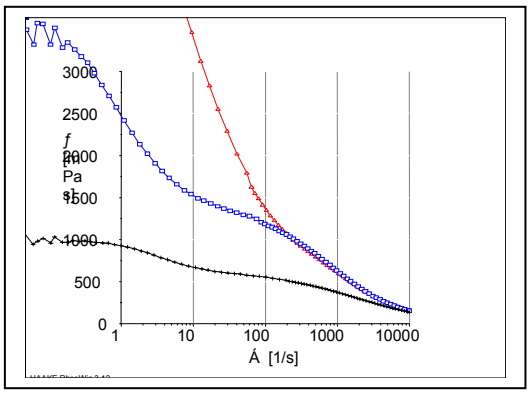
Styrene - Acrylate + **propylene glycol**

Styrene - Acrylate + **butyl-di-glycol**

Combination of HEUR-thickeners

Due to the Newtonian flow behavior Borchi® Gel 0434 brings, it is the ideal tool to adjust the viscosity of waterborne paints. In combination with other Borchi® Gel additives, the storage stability and sag tendency can be improved. Suitable products include the polyurethane based thickeners Borchi® Gel PW 25 and Borchi® Gel 0621, as well as acrylate based Borchi® Gel ALA.

Picture 3 shows a pseudoplastic rheological profile with polyurethane associative thickeners in a styrene acrylate resin binder. The combination of Borchi® Gel 0434 with Borchi® Gel 0621 provides a distinctive shear thinning behavior (red curve), while Borchi® Gel PW 25 generates a more Newtonian flow profile (blue curve). In addition, the viscosity in the shear rates of > 1000 s^{-1} is increased due to synergy effects.



By using thickener combinations, a raised viscosity in lower shear forces leads to improved storage stability and sag resistance on vertical substrates.

Basis: Styrene-Acrylate	ICI viscosity
+ **Borchi® Gel 0434**	1,5 - 2,5
+ Borchi® Gel 0434 + **Borchi® Gel PW 25**	2,0 - 3,0
+ Borchi® Gel 0434 + **Borchi® Gel 0621**	2,0 - 3,0

Gaining color strength

Borchi® Gel 0434 provides additional emulsifying properties that increase color development when tinting with pigment concentrates. Picture 4 shows the increased color strength of a white based glossy latex paint which has been tinted with Luconyl black 5-GU, BASF AG.

Picture 4: Colour development

Basis	glossy latex paint, white
pigment conc:	Luconyl black 5-GU, 5 %

left:	Borchi® Gel 0434
middle:	HEUR thickener I
right:	HEUR thickener II

Borchi® Gel 0434 can be incorporated in any formulation step, even as a post addition. Due to our experience, for increasing color acceptance, a combination of Borchi® Gen DFN, water and Borchi® Gel 0434 can be used. Mix components in equal shares, addition should not exceed 2% weight based on the total weight of the system.

Stability against syneresis and sedimentation

Borchi® Gel 0434 significantly improves the stability of a formulation against syneresis and settling. Can be used solely as an anti-settling agent. The effect is independent of resin binder type and various components in the formulation.

Picture 5: Syneresis in an ethylene vinyl copolymer resin binder

Due to the interactions of components in the paint, emulsifiers and stabilizers can be displaced from the surface of the dispersion solids. This leads to liquid phase separation or syneresis.
Using the wrong type HEUR thickener can enhance this effect.
Picture 5 shows the effect of syneresis in a latex paint based on ethyl vinyl acetate using a common HEUR thickener.

Picture 6: Addition of Borchi® Gel 0434

Borchi® Gel 0434 develops additional emulsifying properties supporting the overall stabilization of waterbased paint formulations. (picture 6). Thus a homogeneous free flowing behaviour is obtained.

Attachment

Starting formulations and application examples

A.) Industrial coatings

Clear Coat for wood substrates based on Bayhydrol VP LS 2342 (Bayer Material Science AG)

raw material		weight [g]	supplier
	Bayhydrol VP LS 2342	91.45	Bayer Material Science AG
	water	2.5	
	butyl-di-glycol	2.5	
	Baysilone® 3466	0.2	OMG Borchers GmbH
	Baysilone® 3468	0.5	OMG Borchers GmbH
	Aquacer 535	2.0	Byk Cera b. v.
	Borchi® Gel 0434	0.75	OMG Borchers GmbH
	total	100	

characteristic data	solid [%]	33 +/- 1
	flow time DIN-Becher 4mm [sec]	30

B.) Latex paints for architectural and decorative application

Interior and exterior semi gloss coating based on Rhoplex SG 10M (Rohm&Haas)

raw material		weight [g]	supplier
	propylene glycol	59.0	
	water	10.2	
	Tamol 731 A	12.7	Rohm&Haas
	Foamaster VL	1.0	Cognis
	Ti-Pure R- 900	248.0	DuPont
	disperse 20 min. at 2500 rpm		
	water	81.0	
	Rhoplex SG 10 M	469.6	Rohm&Haas
	Texanol	23.0	
	Foamaster VL	1.0	Cognis
	Borchi® Gel 0434	32.4	OMG Borchers GmbH
	Borchi® Gel 0621	1.1	OMG Borchers GmbH
	water	61.0	
	total	1000	

characteristic data	PVC	23.7 %
	pH	8.8
	Krebs Stormer viscosity (KU)	95
	gloss, 60°	73

Interior/exterior highly filled latex paint based on Acronal 290 D (BASF AG)

raw material		weight [g]	supplier
	water	12.7	
	Borchi® Gen NA 40	1.0	OMG Borchers GmbH
	Preventol D 6	2.1	LANXESS AG
	Byk 036	0.2	Byk Chemie
	Natrosol 330 Plus	0.1	Aqualon
	AMP 95	1.0	Angus
	Kronos 2190	20.0	Kronos
	Durcal 2	9.0	Omya
	Plastorit 000	2.0	Kremer
	Acronal 290 D	43.0	BASF
	Dowanol DPnB	1.4	Dow
	Borchi® Gel 0434	1.1	OMG Borchers GmbH
	Byk 036	0.3	Byk Chemie
	Colloid 643	2.5	Rhodia
	Total	1000	

characteristic data		
	Krebs Stormer viscosity [KU]	104
	ICI viscosity	1.5 - 1.8

Still questions left?

The team OMG Borchers will be always at your service

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