BU Emulsions

Clariant

Exactly your chemistry.

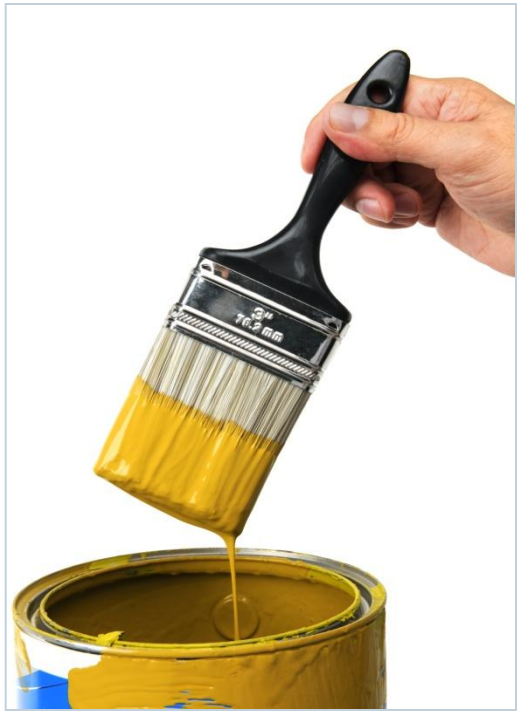
Thickener

Mowiplus TK 530, for emulsion paints

Fluidity is important in every application for paints
流动性对涂料非常重要

Clariant

Exactly your chemistry.

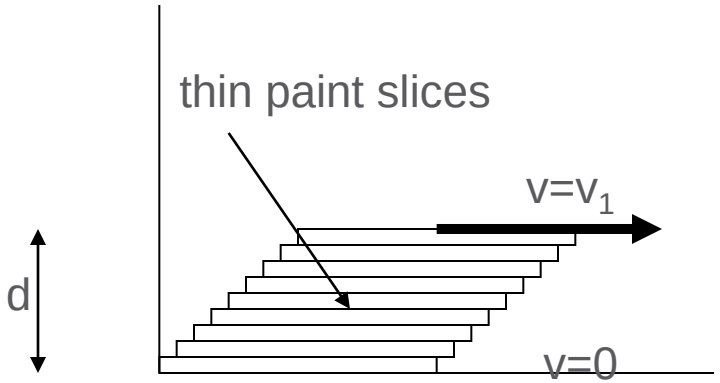


What is rheology?
什么是流变性？

Clariant

Exactly your chemistry.

Definition of Viscosity
粘度的定义



$$\text{shear stress } \tau = \frac{\text{force } F}{\text{surface } A}$$
剪应力

$$\text{shear rate } D = \frac{\text{velocity } v}{\text{distance } d}$$
剪切速率

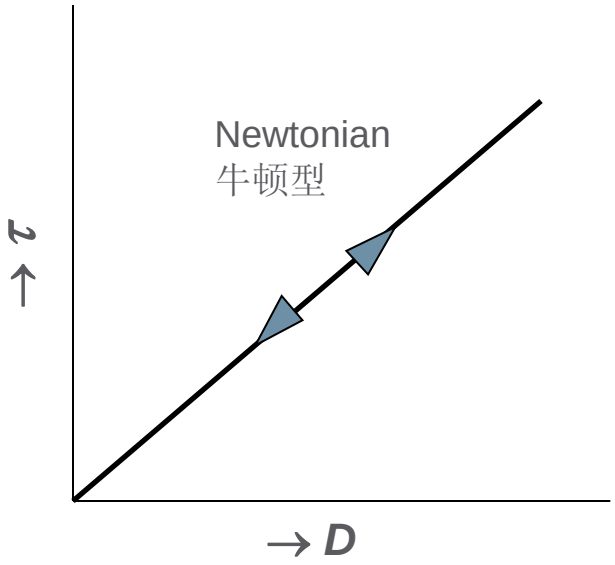
Proportionality between τ and D: $D \propto \tau$

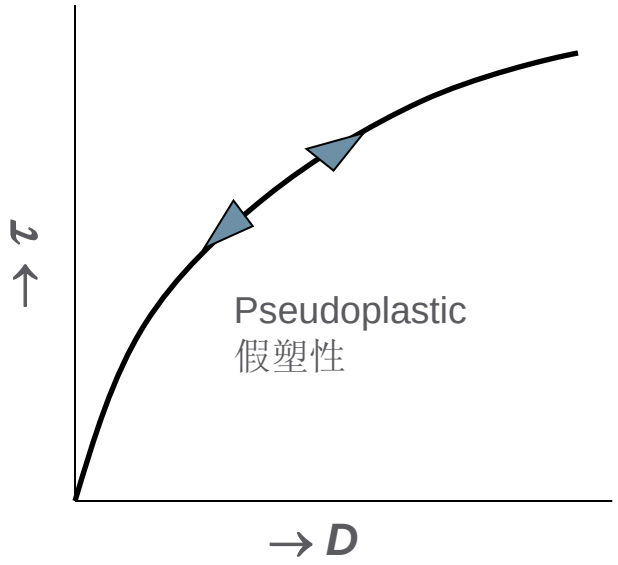
constant of proportionality: η $D \bullet \eta = \tau$

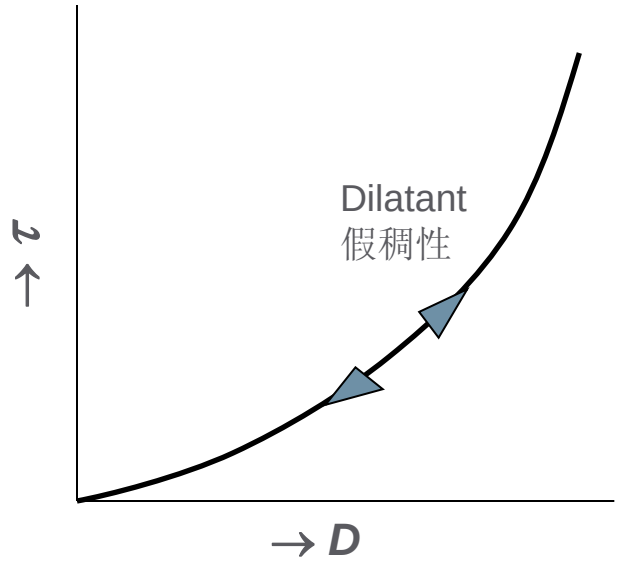
$$\text{Viscosity } \eta = \frac{\tau}{D} \qquad [1\,\text{mPa} * \text{s} = 1\,\text{cP}]$$
粘度

Rheological Behaviour of Liquids
液体的流变学行为

Clariant
Exactly your chemistry.







Examples: water, mineral oil | **Emulsion** | **Wet sand at the beach**

Newtonian Liquids:

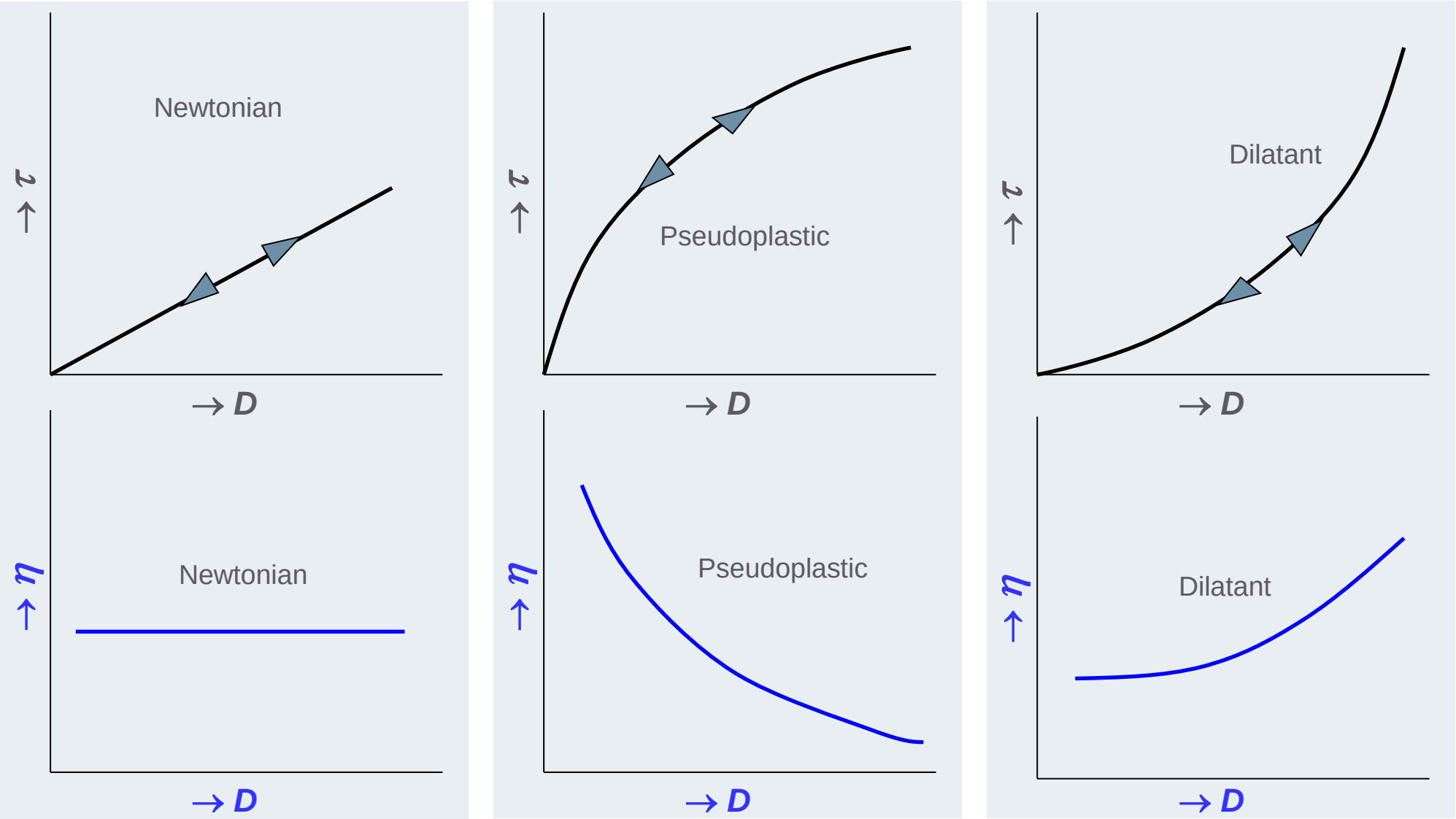
η does not depend on *D*

Pseudoplastic and Dilatant Liquids:

η depends on *D*

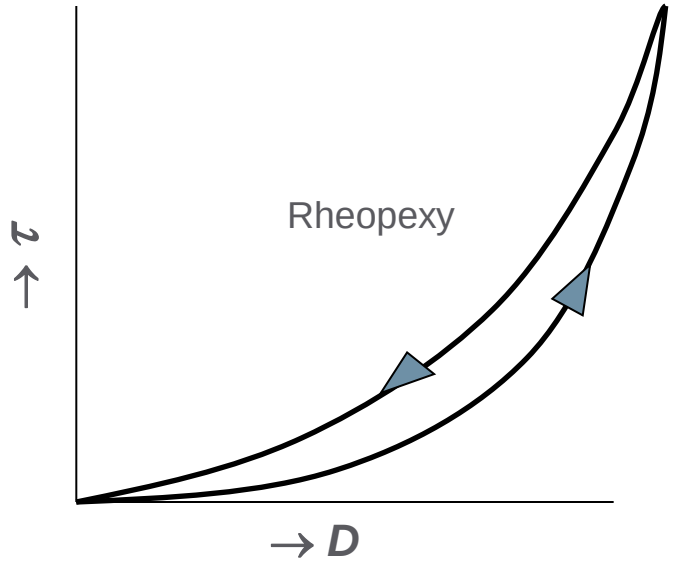
Different Graphical Representations
粘度/剪应力/剪切速率之间关系示意图

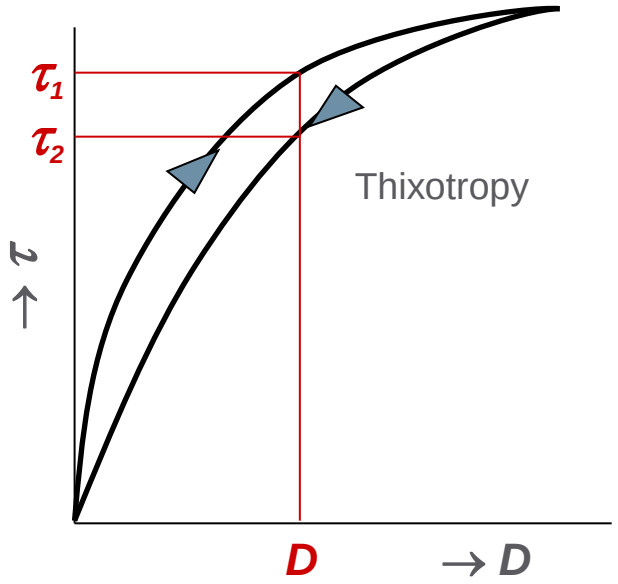
Clariant
Exactly your chemistry.



Time-Dependend Rheological Behaviour
流变学行为与时间的关系

Clariant
Exactly your chemistry.

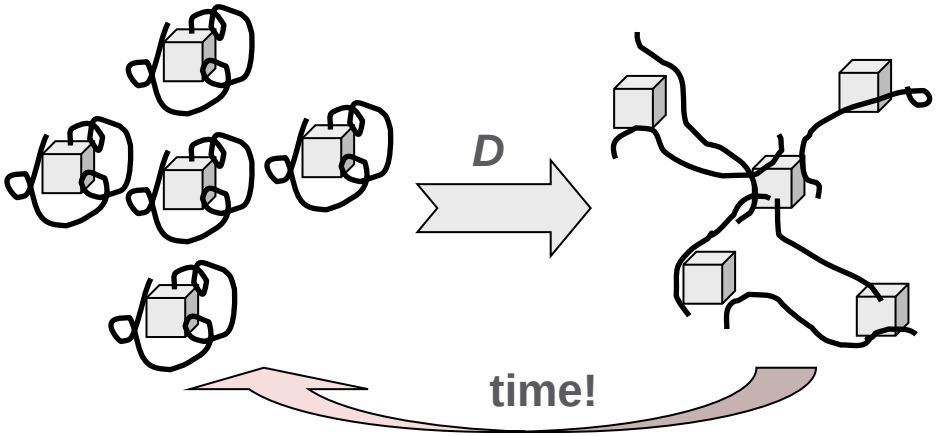


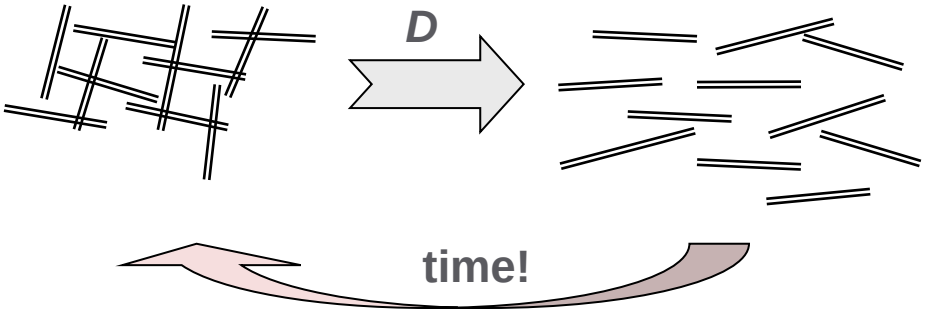


$$\eta_1 = \frac{\tau_1}{D}$$

$$\eta_2 = \frac{\tau_2}{D}$$

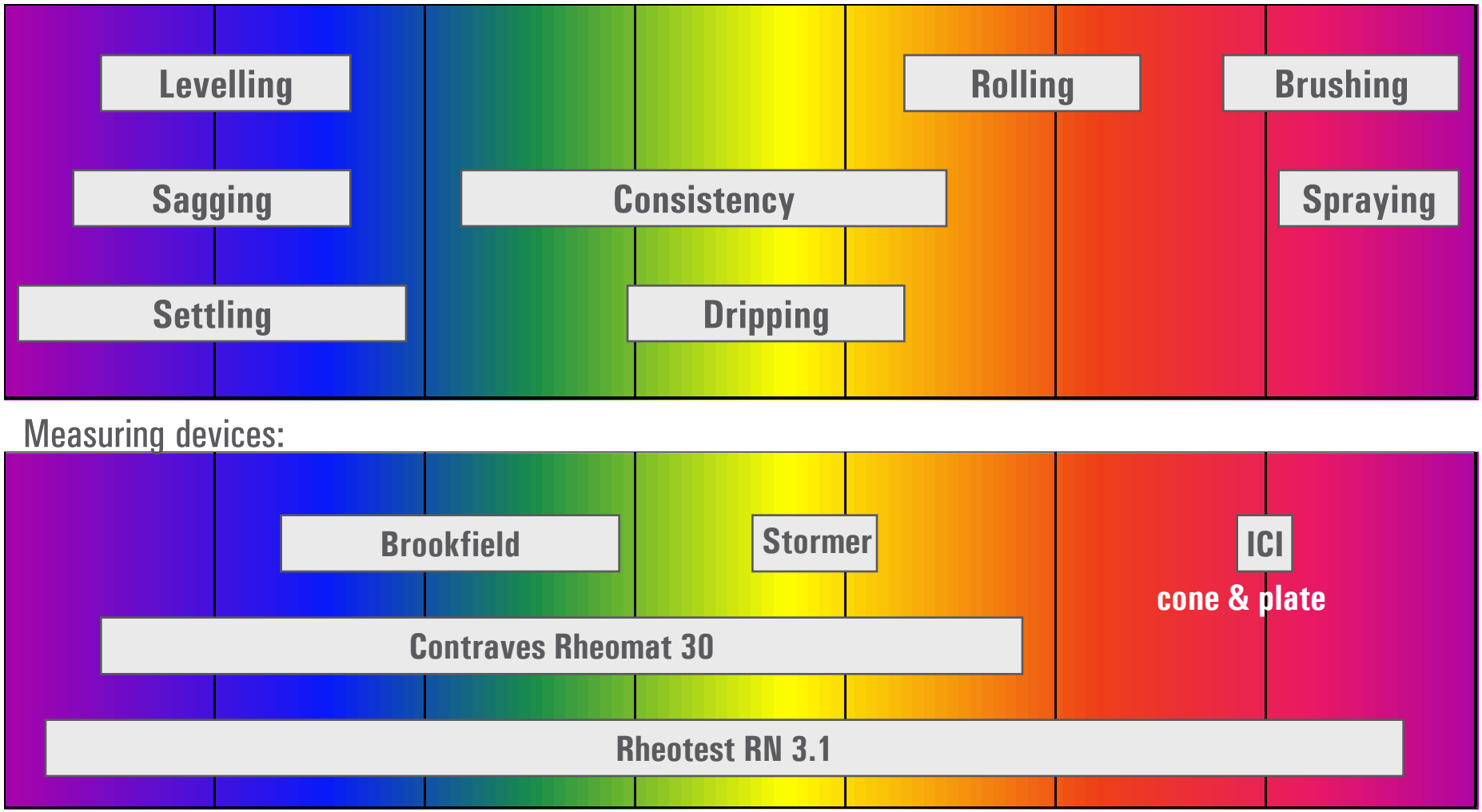
$$\eta_1 > \eta_2$$





Relationship of Shear Rate to Paint Properties
涂料的性能与剪切率

Clariant
Exactly your chemistry.



Thixotropy
触变性

Clariant
Exactly your chemistry.

1. Shear thinning
   剪切变稀

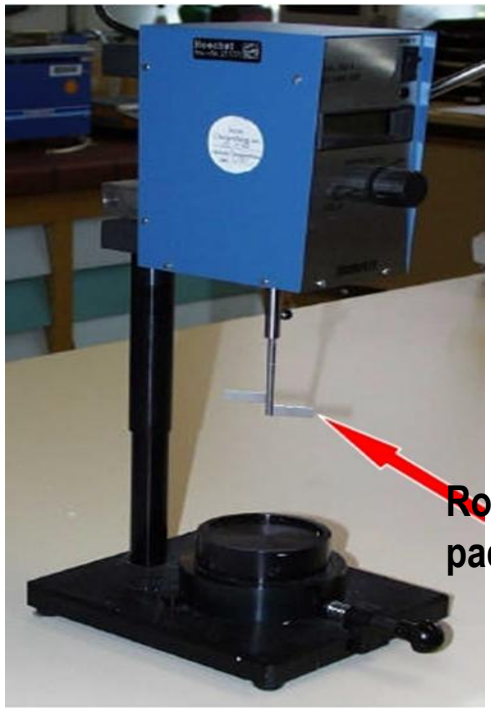
2. Lower viscosity remains a certain time
   低粘度保持一段时间

3. Formation of structure combined with increase in viscosity
   随着粘度的增加形成结构体

流变性能测定仪 / 粘度仪

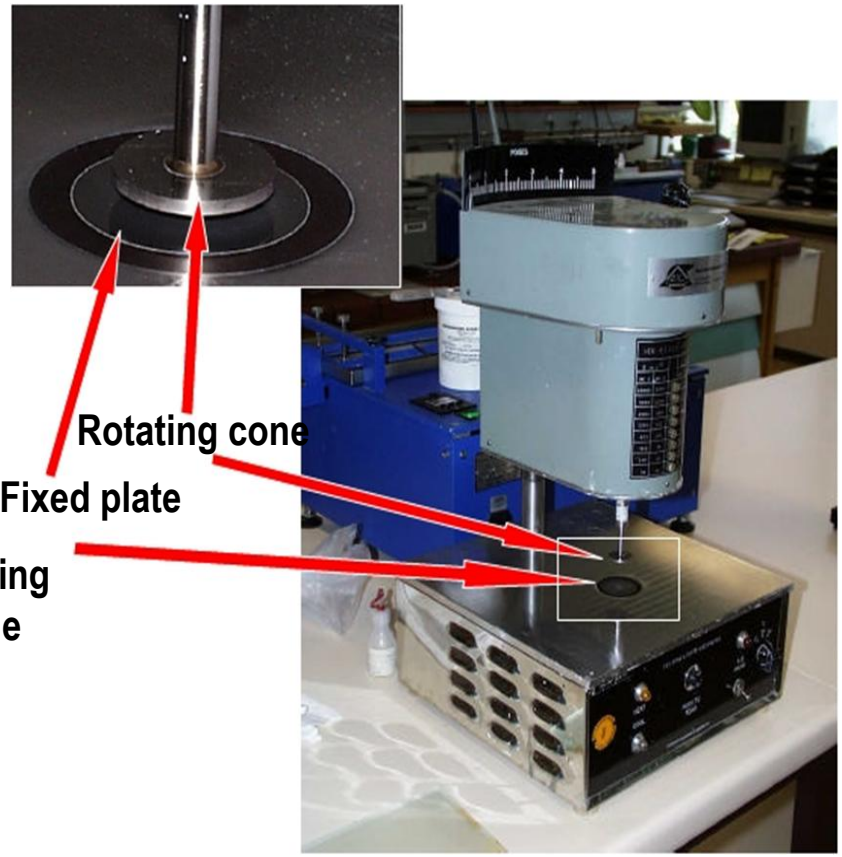
For low shear rates

低剪切率



For middle shear rates

中剪切率

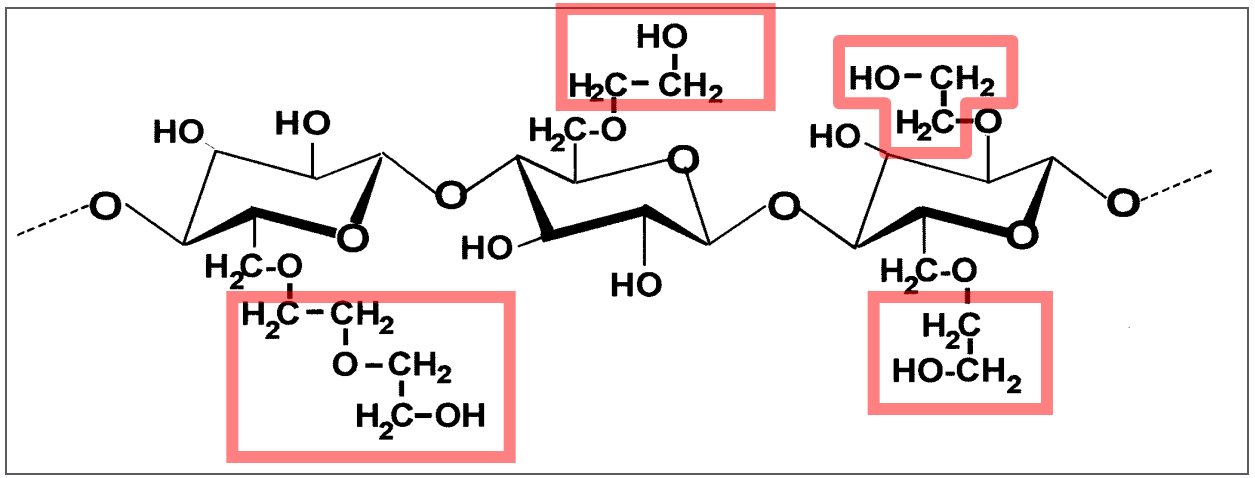


For high shear rates

高剪切率

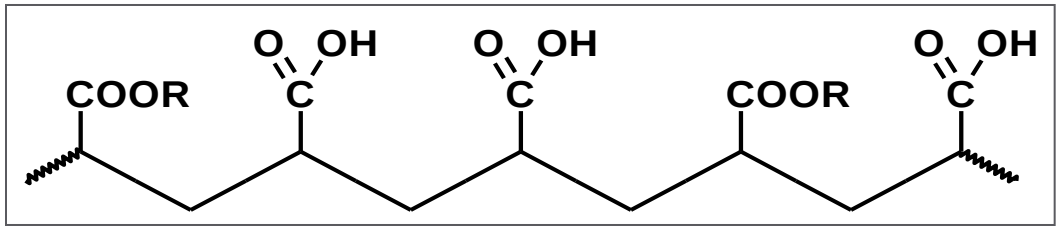
Types of Thickeners
增稠剂的类型

Clariant
Exactly your chemistry.



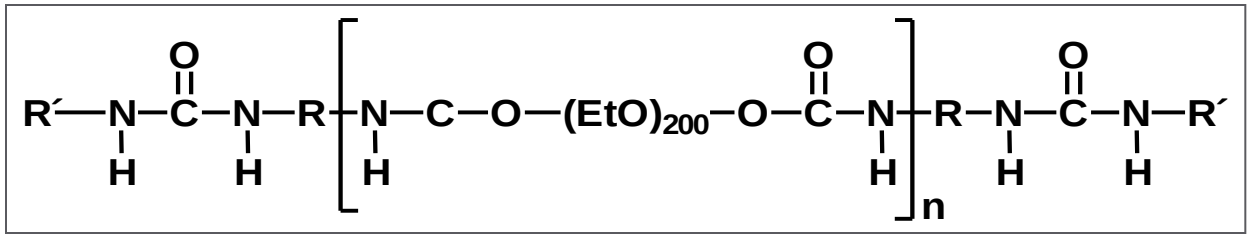
（一）：cellulosic ether **HEC**
(**H**ydroxy **E**thyl **C**ellulose)

Product: Tylose®



（二）：ASE
(**A**lkali **S**wellable **E**mulsion)
→ conventional acrylic thickener

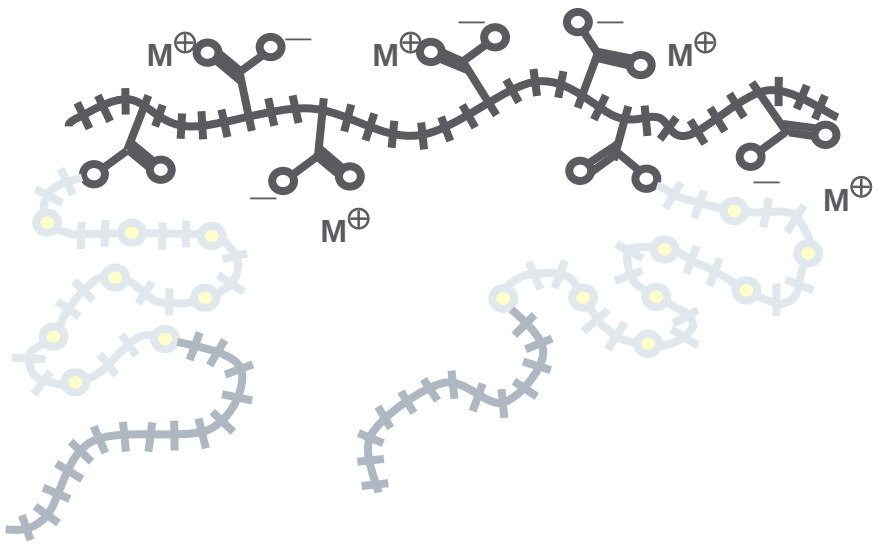
Clariant Product: Mowilith LDM 7010



（三）：HEUR
(**H**ydrophobically Modified
Ethylene Oxide - **U**rethane
Rheology Modifier)

Clariant Products: none
R & H: Acrysol RM-8 W, RM-2020

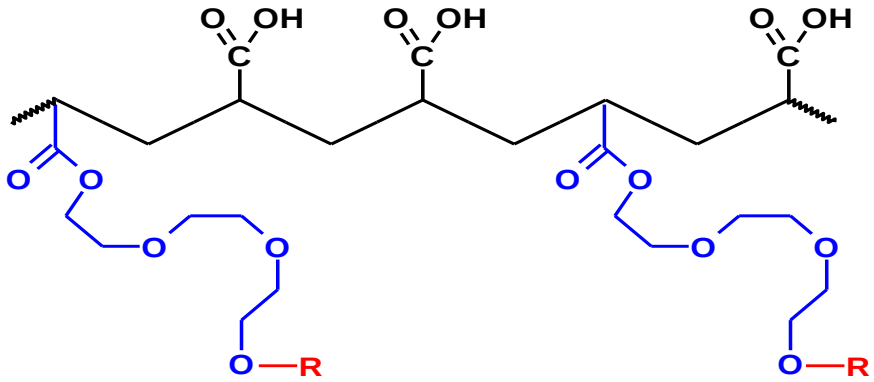
Types of Thickeners
增稠剂的类型



（四）：HASE
(**H**ydrophobically modified **A**lkali **S**wellable **E**mulsion)

Clariant Products: Mowilith LDM 7002
Mowilith LDM 7020
Mowiplus TK 530

chemical structure:



carbon chain with acidic groups

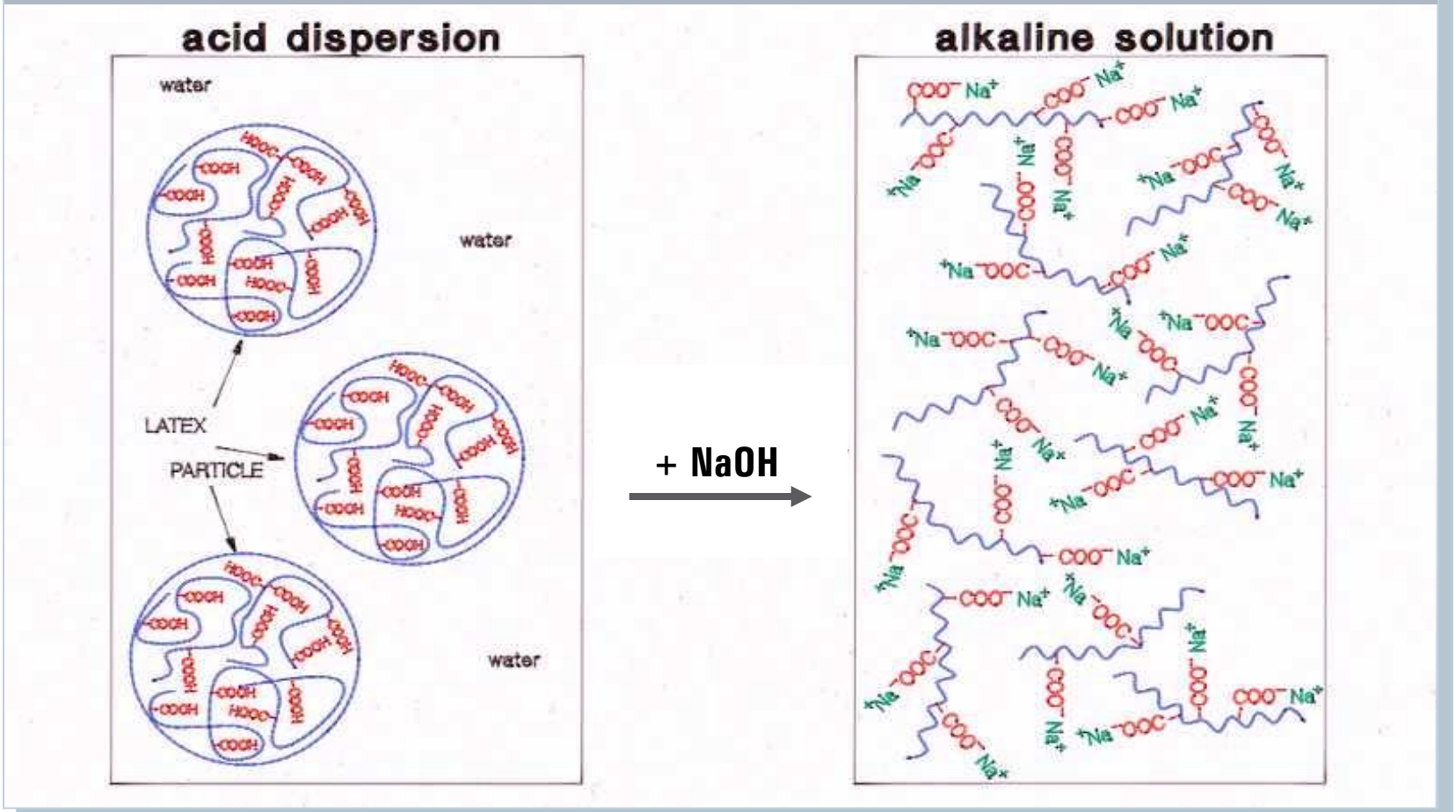
hydrophilic spacer

hydrophobic (e.g. alkyl) groups

碱溶胀增稠剂的增稠机理

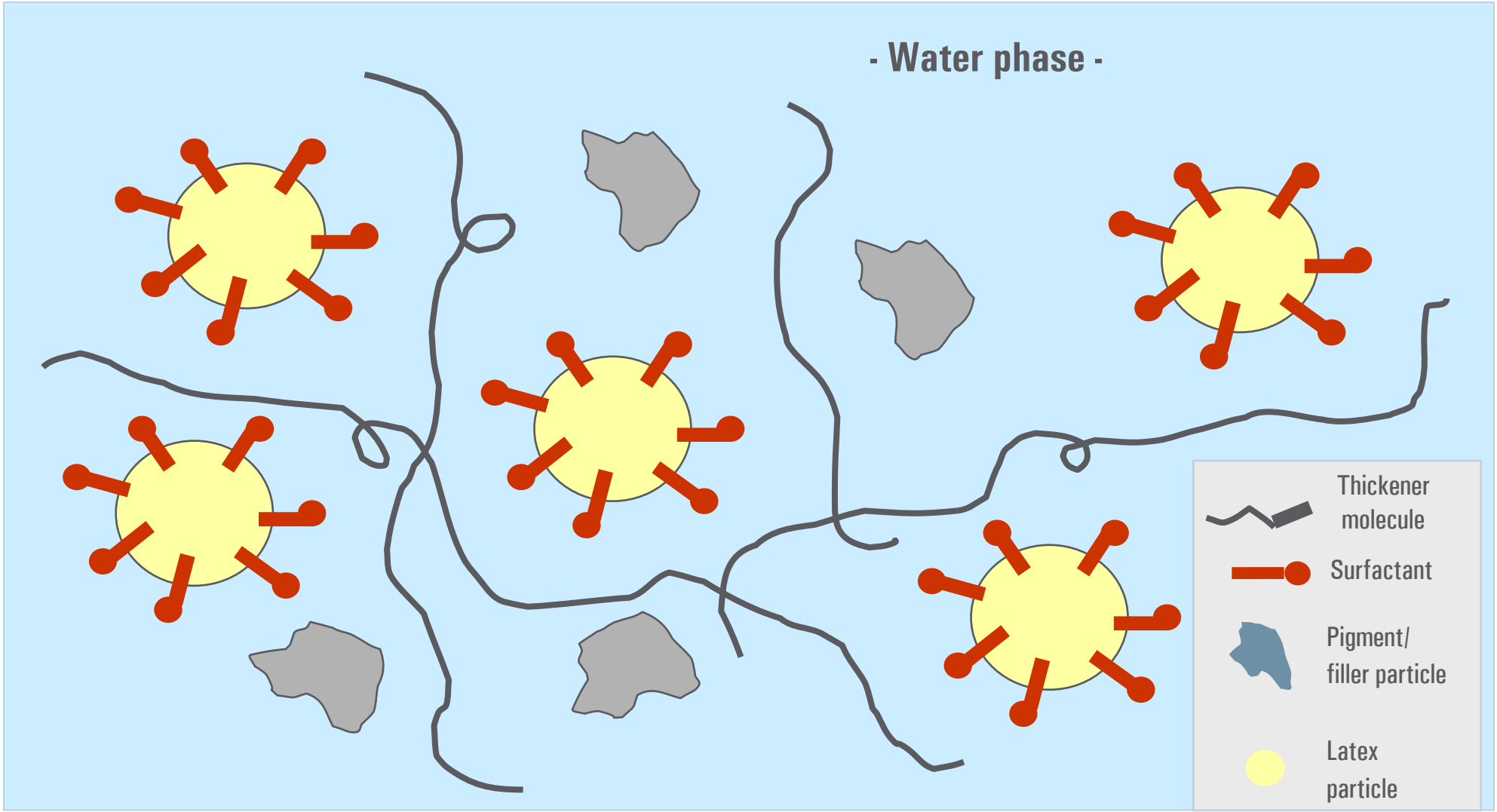
Clariant
Exactly your chemistry.

Thickening Mechanism on Neutralization of conventional Acrylate-Thickener



Mechanism of Thickening with HEC
羟乙基纤维素的增稠机理

Clariant
Exactly your chemistry.

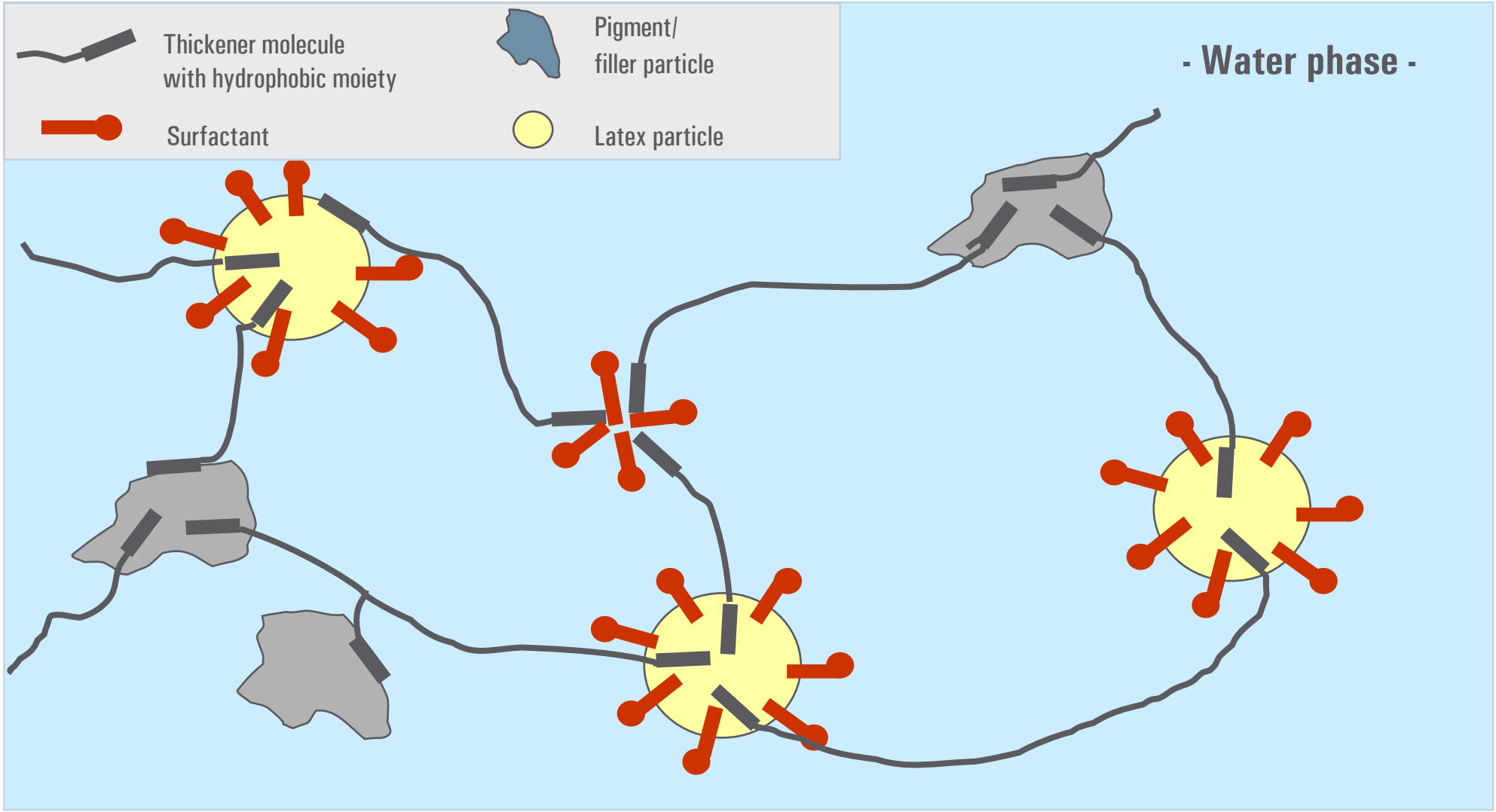


Mechanism of Thickening with HASE

疏水改性碱溶胀增稠剂的增稠机理

Clariant

Exactly your chemistry.



Thickeners for Emulsion Paints – Summary

增稠剂特性小结

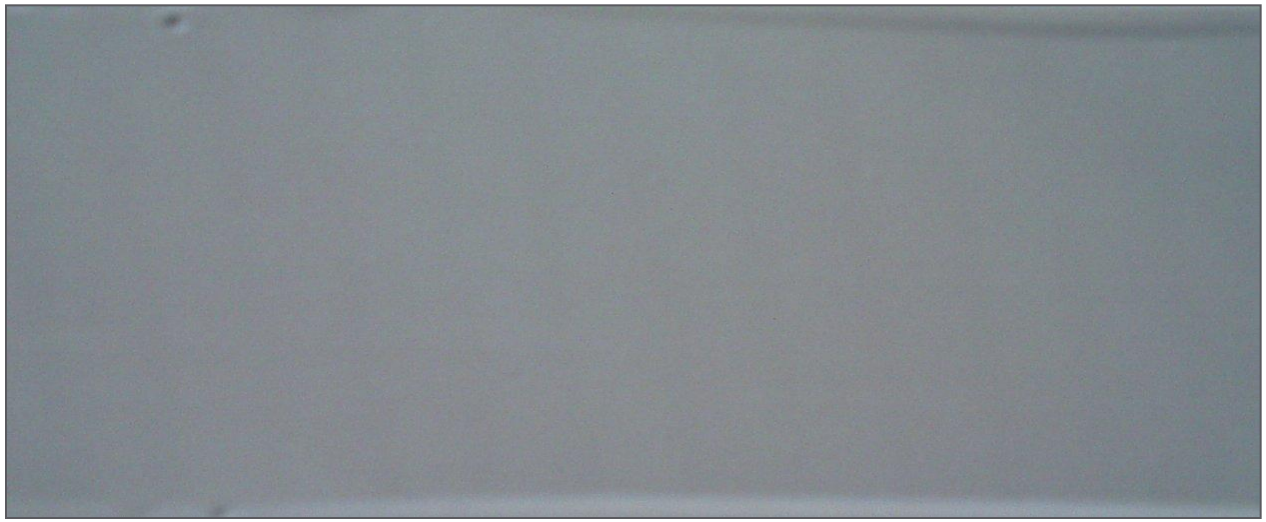
Clariant

Exactly your chemistry.

	Cellulosic Ethers (Tylose, HEC)	ASE (LDM 7010)	HASE (TK 530)	HASE (LDM 7002)	HEUR (Competitor RM-8)
Mode of thickening	liquid phase	liquid phase	liquid phase and associative	liquid phase and associative	associative
Viscosity profile	strong pseudoplastic	pseudoplastic	less pseudoplastic	nearly newtonian	newtonian up to pseudoplastic
Handling	+	+ +	+ +	+ +	+ / -
Stability against microbial attack	-	+	+	+	+
Cost	+	+ / -	+ / -	+ / -	-
Application fields	flat indoor and exterior paints Latex paints	texture paints	flat indoor and exterior paints Latex paints	gloss paints wood stains	universal

Impact of Thickeners on Levelling
增稠剂对流平性的影响

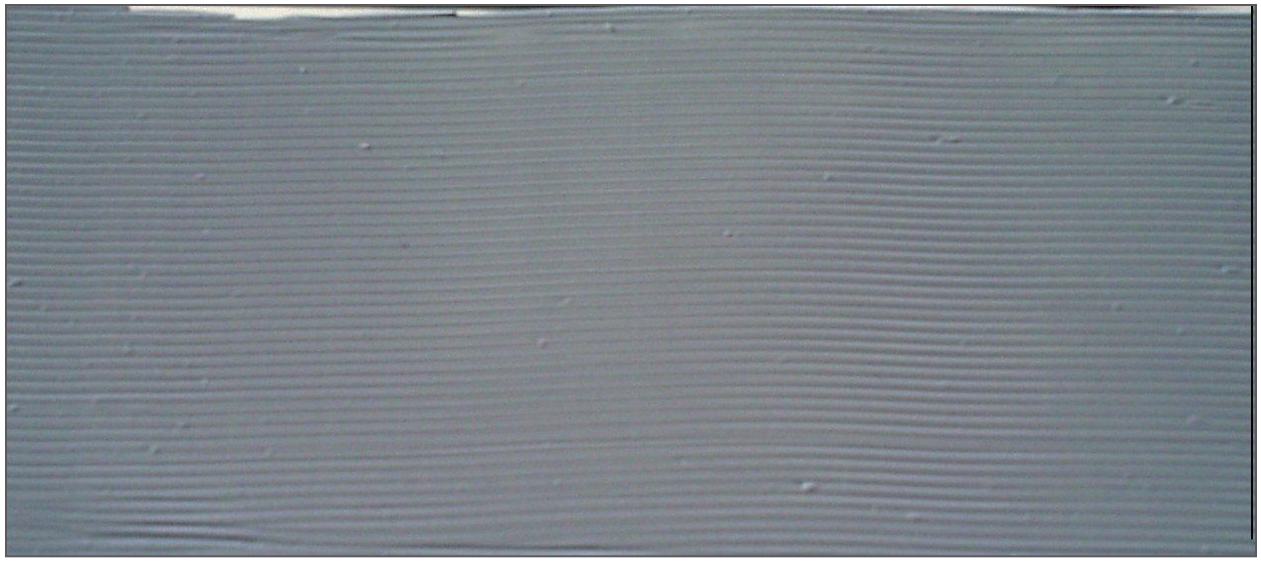
Clariant
Exactly your chemistry.



Recipe with
56 % Acrylic Dispersion

Thickener: LDM 7002

⇒ Excellent levelling



Recipe with
56 % Acrylic Dispersion

Thickener: LDM 7010

⇒ Poor levelling

Comparison between Cellulosic Ethers and HASE
HEC/HASE增稠剂的比较

Clariant
Exactly your chemistry.

Matt paints平光漆

Cellulosic Ether Thickener 纤维素增稠剂

- longer open time
- improved scrub resistance
- no impact of pH-value
- expensive
- susceptible to bacteria

HASE Thickener 疏水改性碱溶胀增稠剂

- short open time
- loss in pigment binding power
- strong impact of pH
- low price
- resistant to bacteria

Semi gloss and gloss paints 半光和高光漆

Cellulosic Ether Thickener

- pseudoplastic rheology

high viscosity at low shear rates
low viscosity at high shear rates

HASE Thickener

- alkyd like rheological behaviour:

levelling similar to alkyd paints
improved brush drag

Acrylic Thickener for paints
丙烯酸增稠剂---Mowiplus TK 530

Clariant
Exactly your chemistry.

Mowiplus	Solids content [%]	Thickener type	Main application field
TK 530	30	HASE	Matt paints, replace of cellulose based thickeners, APEO-free

Compare with

Thickener TT	30	HASE	APEO-free

Comparison of thickener TK 530 and TT in 78%PVC paint
增稠剂在高PVC涂料中的比较

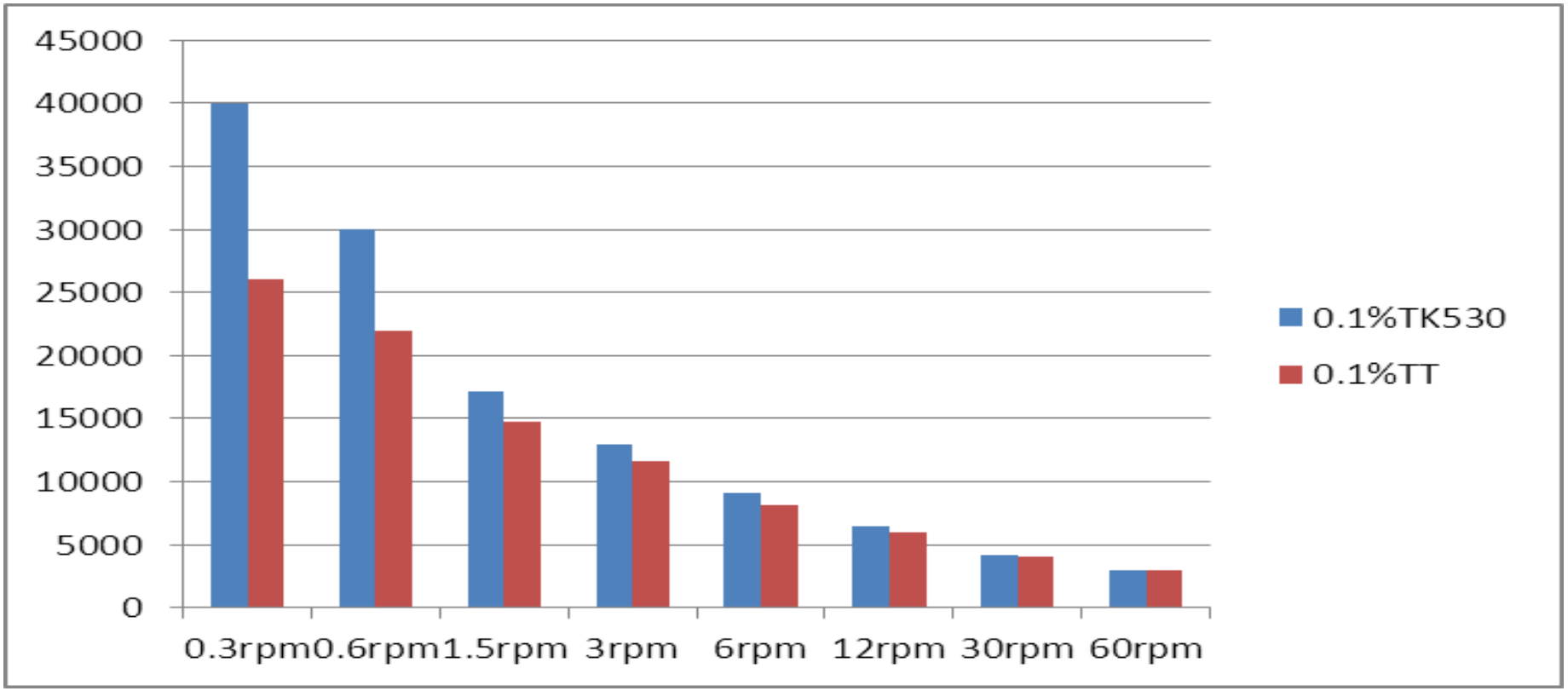
Clariant
Exactly your chemistry.

78%PVC paint based on Mowilith 6710 +thickener				
Viscosity (KU)				
	0	0.1%	0.2%	0.4%
TK 530 initial	74.2	87.5	101.5	112
TK 530 after 24h		94.5	105.3	117
VISC increase		7	3.8	5
TT initial		90.5	104.6	> 140
TT after 24h		98.5	113	
VISC increase		8	8.4	

Comparison of thickener TK 530 and TT in 78%PVC paint
增稠剂在高PVC涂料中的比较

Clariant
Exactly your chemistry.

78%PVC paint based on Mowilith 6710(S/A), Brookfield DV-I+, LV spindle 4#



Comparison of thickener in 78%PVC paint
增稠剂在高PVC涂料中的比较

Clariant
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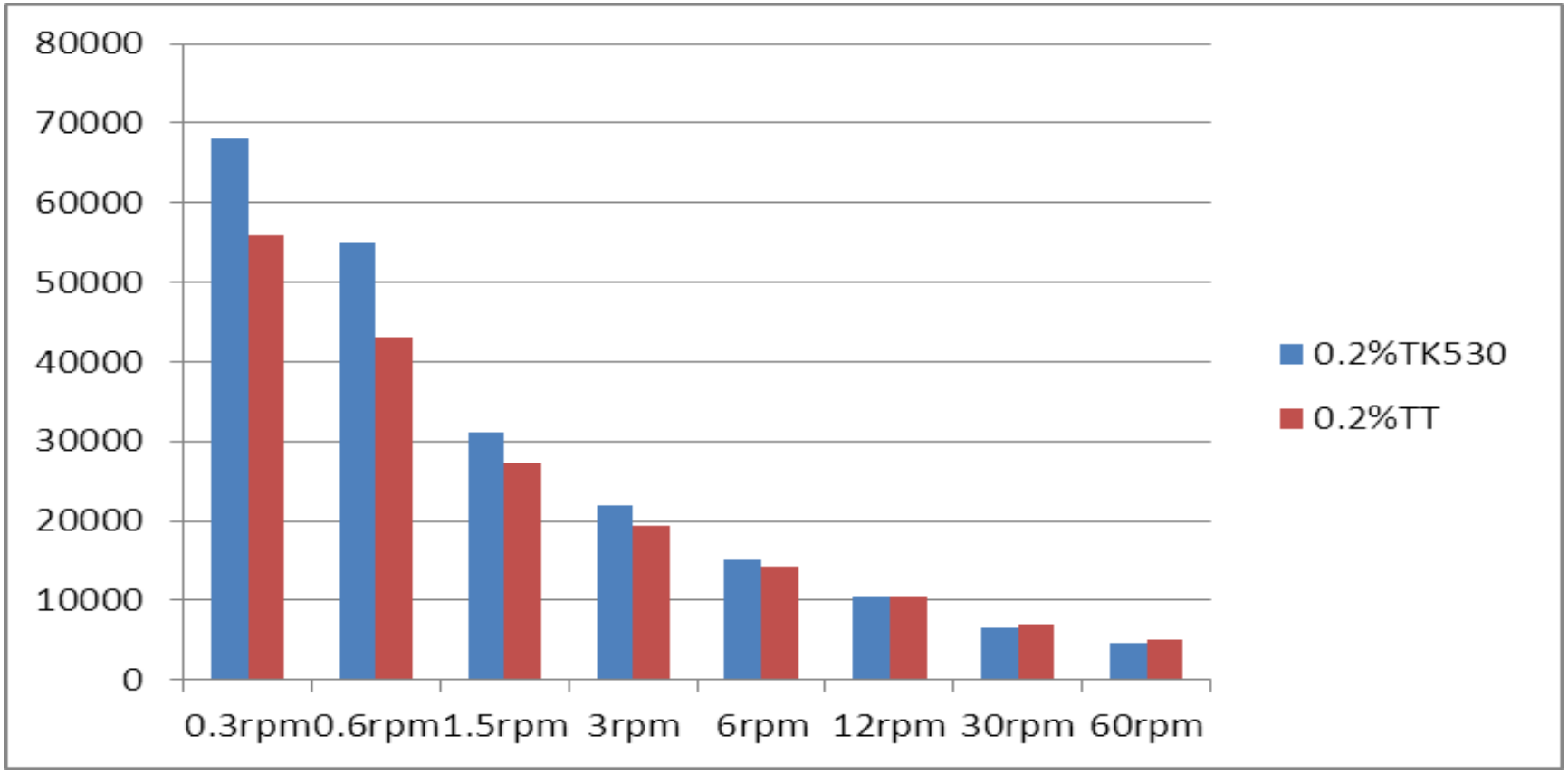
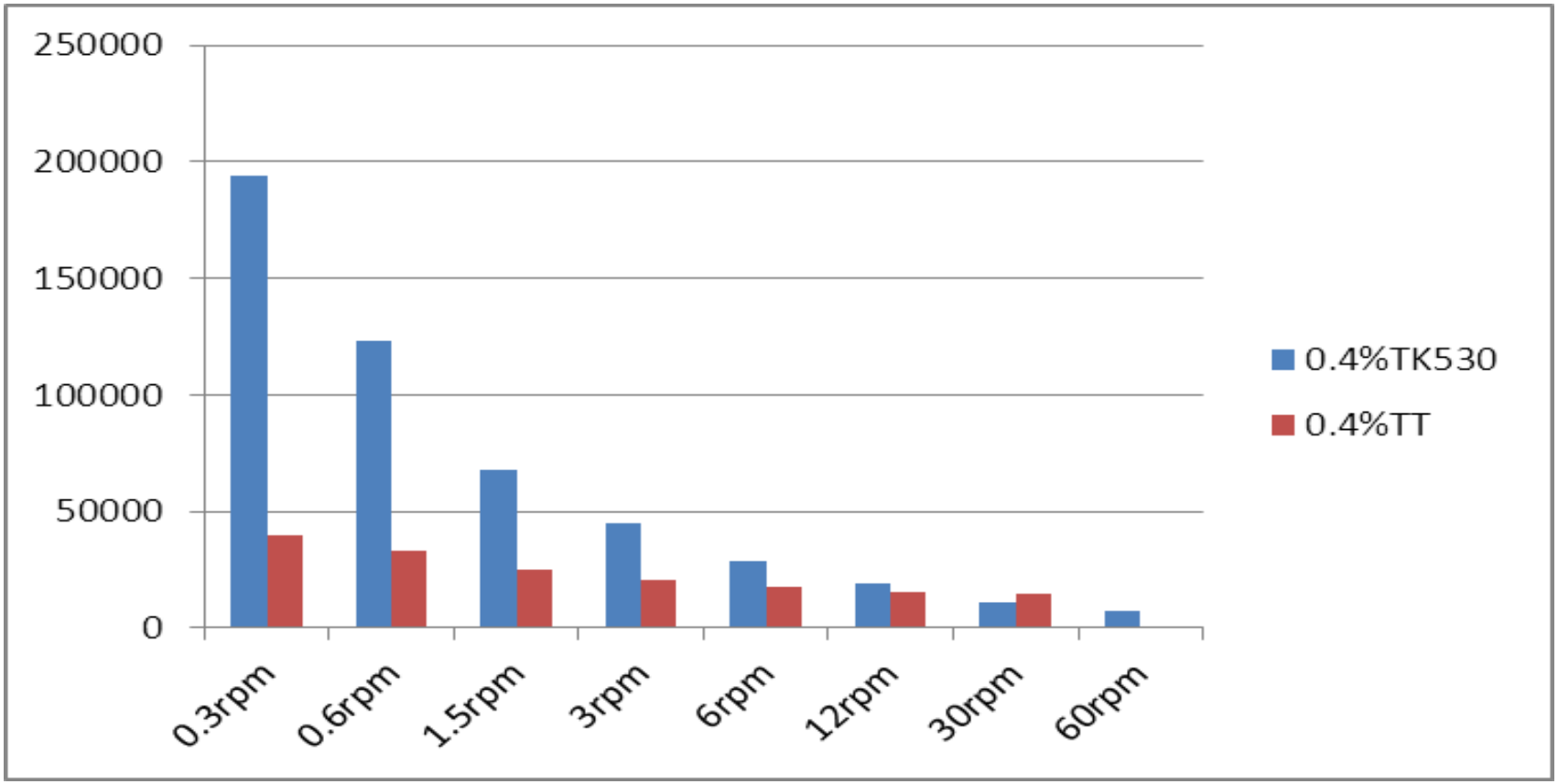
78%PVC paint based on Mowilith 6710(S/A), Brookfield DV-I+, LV spindle 4#



Comparison of thickener in 78%PVC paint
增稠剂在高PVC涂料中的比较

Clariant
Exactly your chemistry.

78%PVC paint based on Mowilith 6710(S/A), Brookfield DV-I+, LV spindle 4#



Comparison of thickener in 78%PVC paint
增稠剂在高PVC涂料中的比较

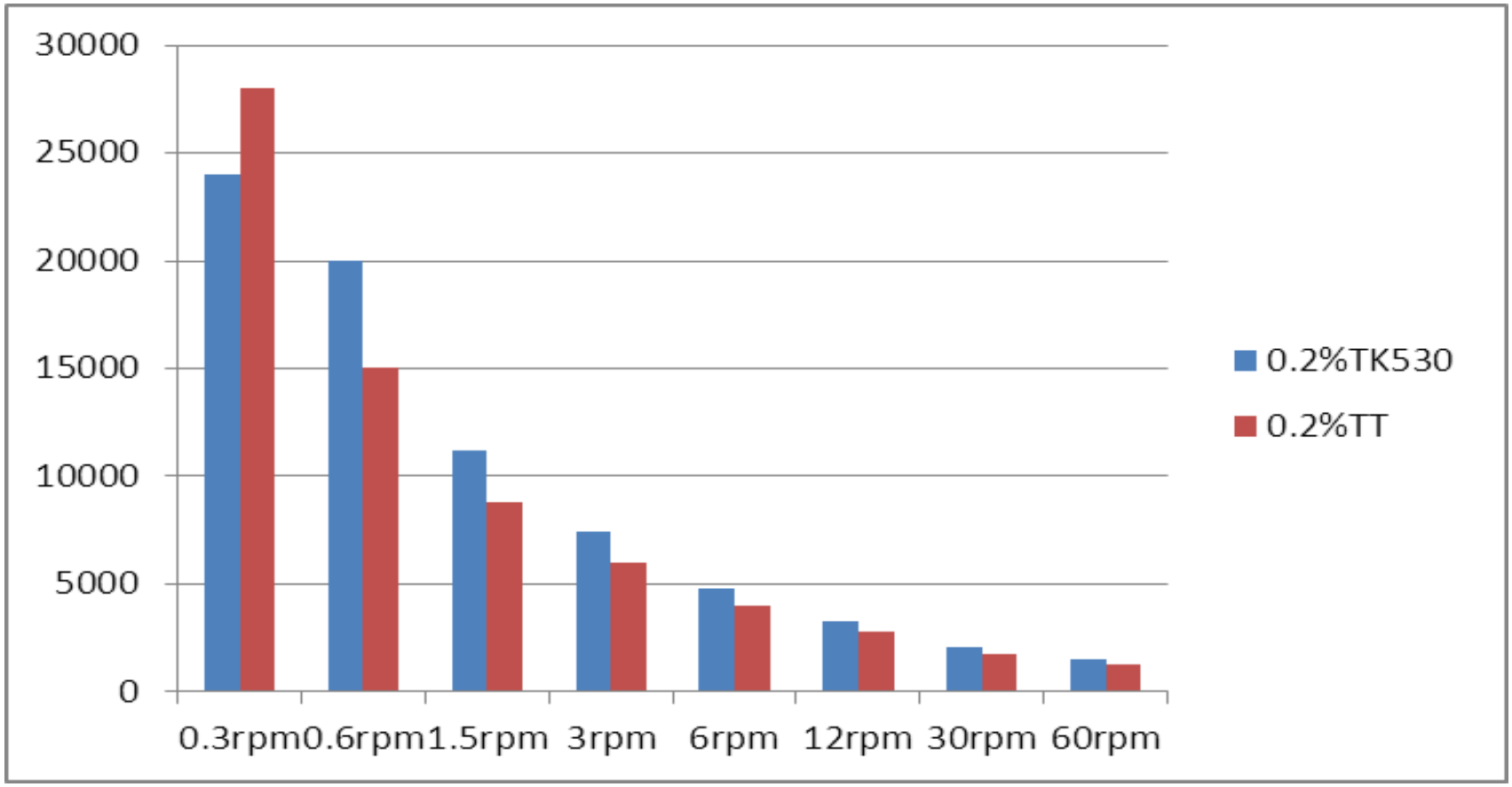
Clariant
Exactly your chemistry.

78%PVC paint based on Mowilith DM 2468 +thickener				
Viscosity (KU)				
	0	0.20%	0.40%	0.80%
TK 530 initial	66.8	73	92.2	113
TK 530 after 24h		77.2	95.5	125.8
VISC increase		4.2	3.3	12.8
TT initial		71	86.6	101
TT after 24h		74.2	90.7	107.8
VISC increase		3.2	4.1	6.8

Comparison of thickener in 78%PVC paint
增稠剂在高PVC涂料中的比较

Clariant
Exactly your chemistry.

78%PVC paint based on Mowilith DM 2468(VAM / VeoVa), Brookfield DV-I+, LV spindle 4#



Comparison of thickener in 78%PVC paint
增稠剂在高PVC涂料中的比较

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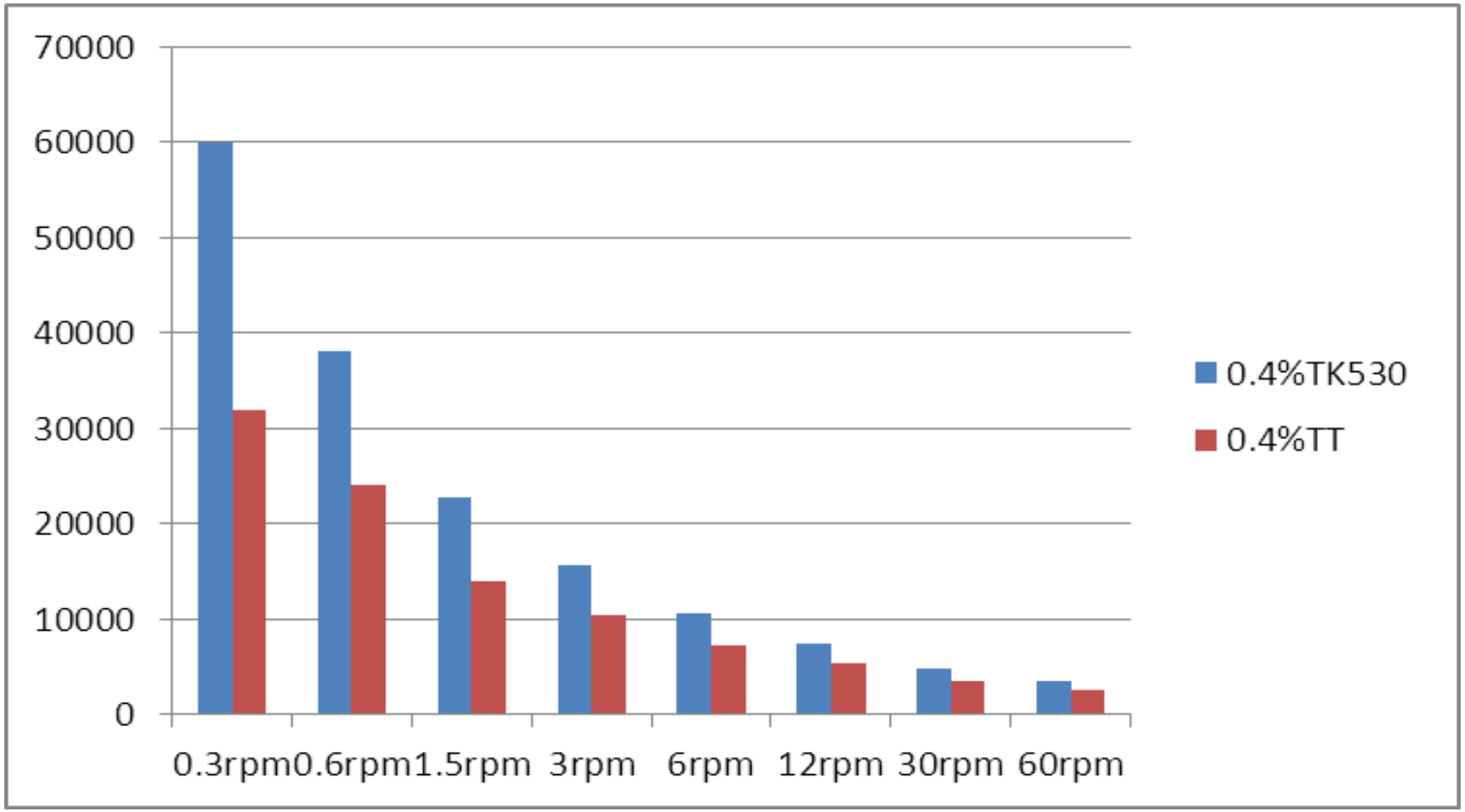

Comparison of thickener in 78%PVC paint
增稠剂在高PVC涂料中的比较

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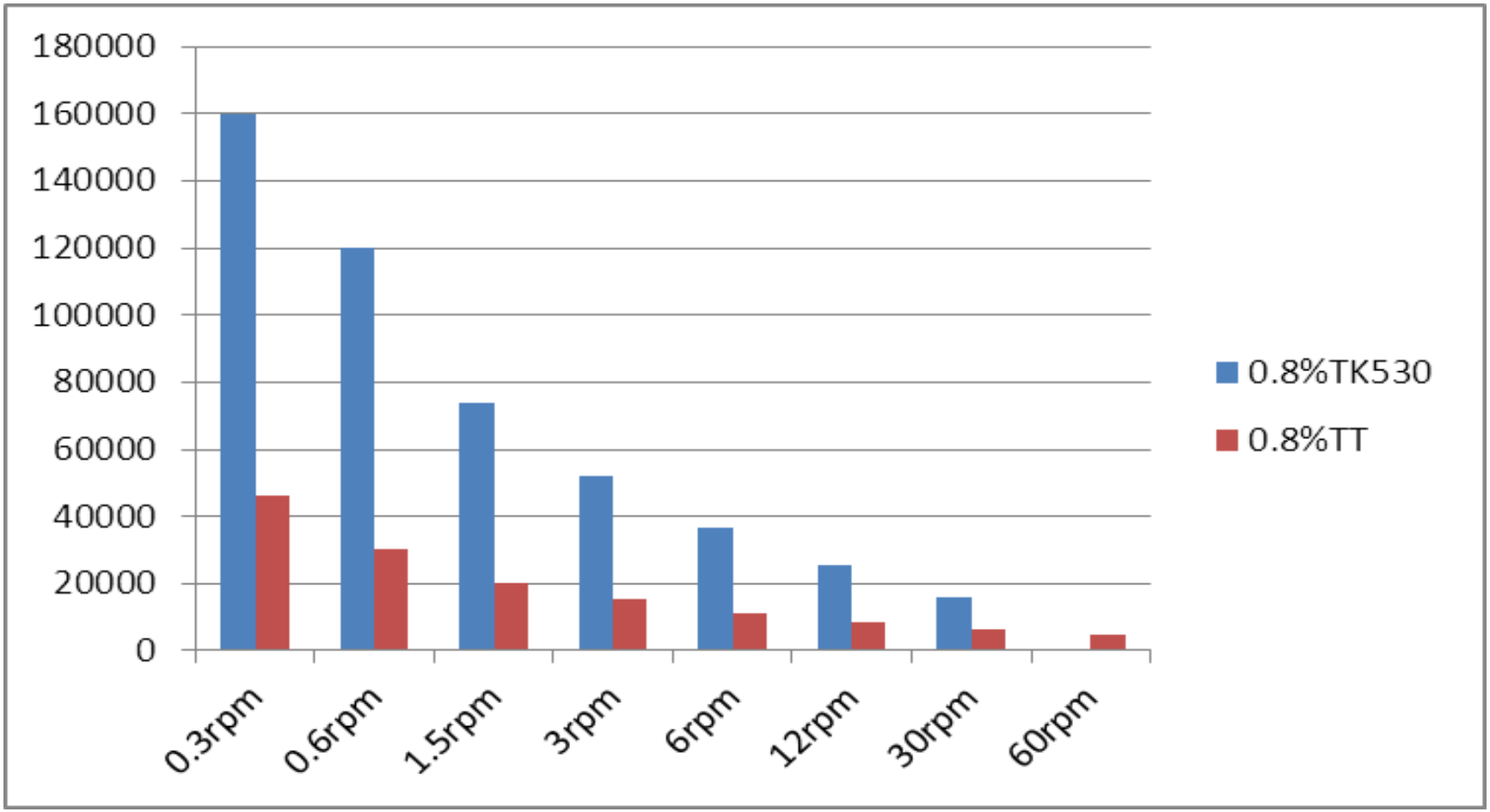


Comparison of thickener in 40%PVC paint
增稠剂在40%PVC涂料中的比较

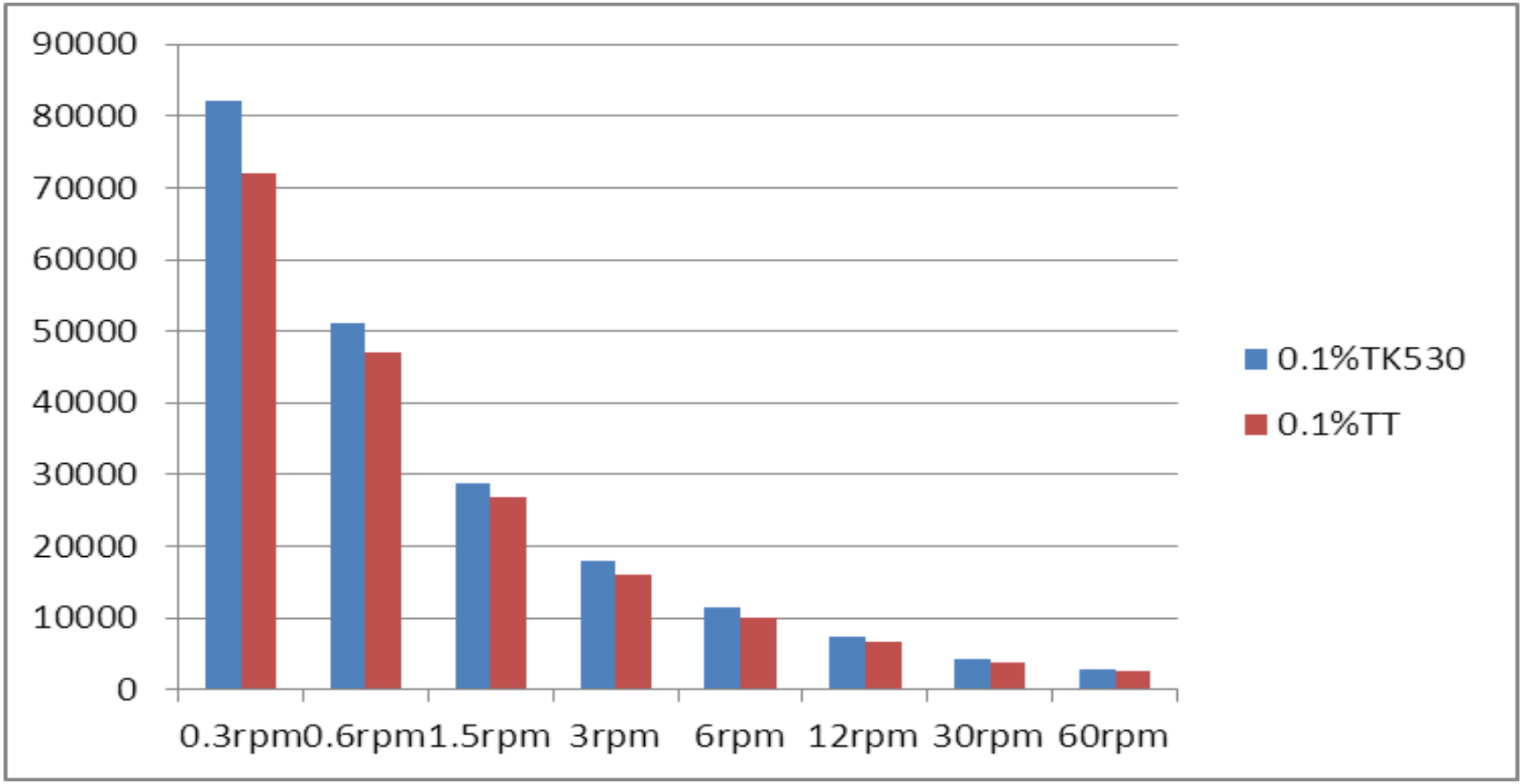
Clariant
Exactly your chemistry.

40%PVC paint based on Mowilith 727M +thickener				
Viscosity (KU)				
	0	0.1%	0.2%	0.4%
TK 530 initial	77.2	82.2	92	116
TK 530 after 24h		89.2	100	121.8
VISC increase		7	8	5.8
TT initial		81.2	89.4	115
TT after 24h		86.6	94.6	117.2
VISC increase		5.4	5.2	2.2

Comparison of thickener in 40%PVC paint
增稠剂在40%PVC涂料中的比较

Clariant
Exactly your chemistry.

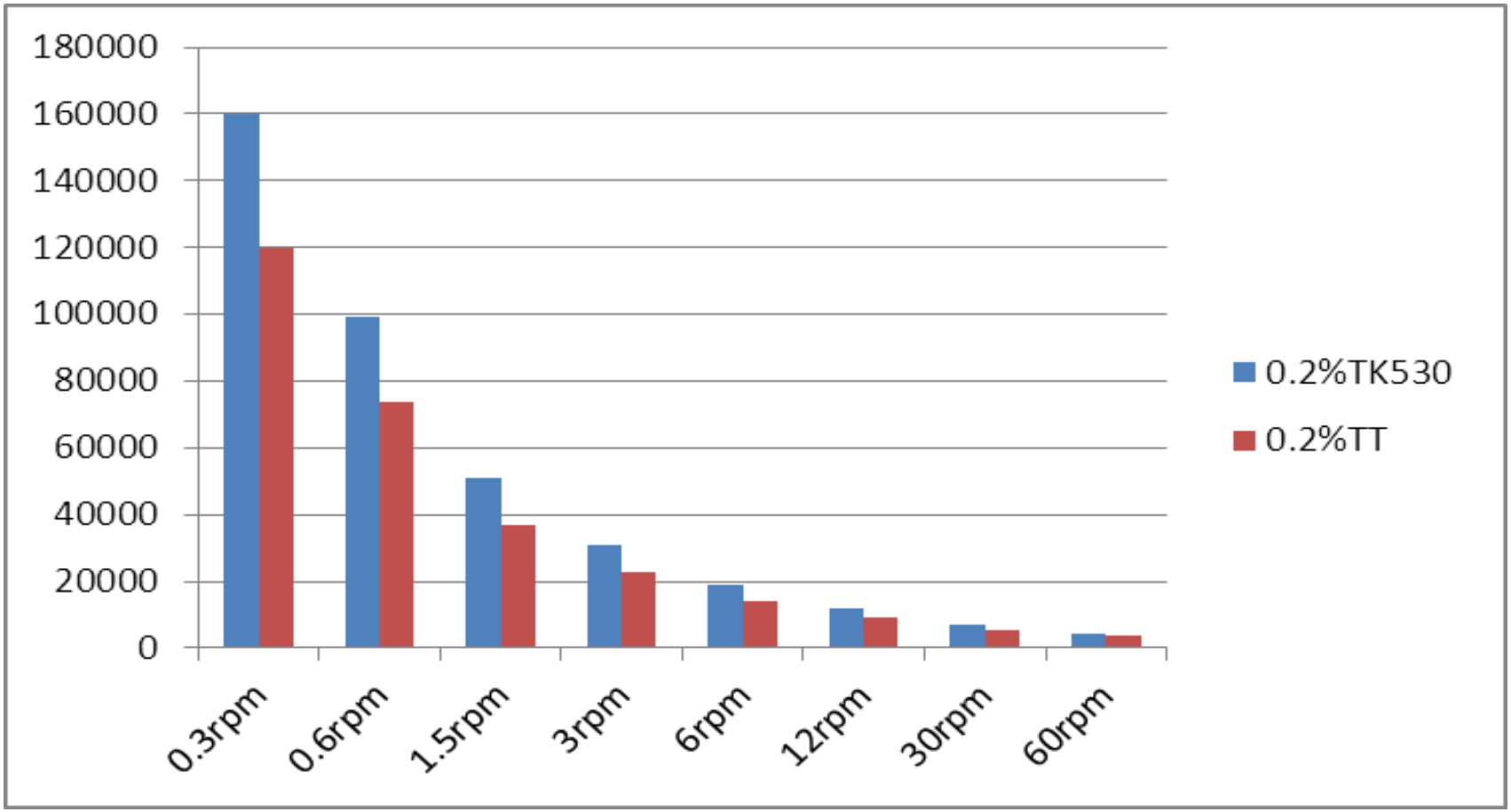
40%PVC paint based on Mowilith 727M(AA), Brookfield DV-I+, LV spindle 4#



Comparison of thickener in 40%PVC paint
增稠剂在40%PVC涂料中的比较

Clariant
Exactly your chemistry.

40%PVC paint based on Mowilith 727M(AA), Brookfield DV-I+, LV spindle 4#



Comparison of thickener in 40%PVC paint
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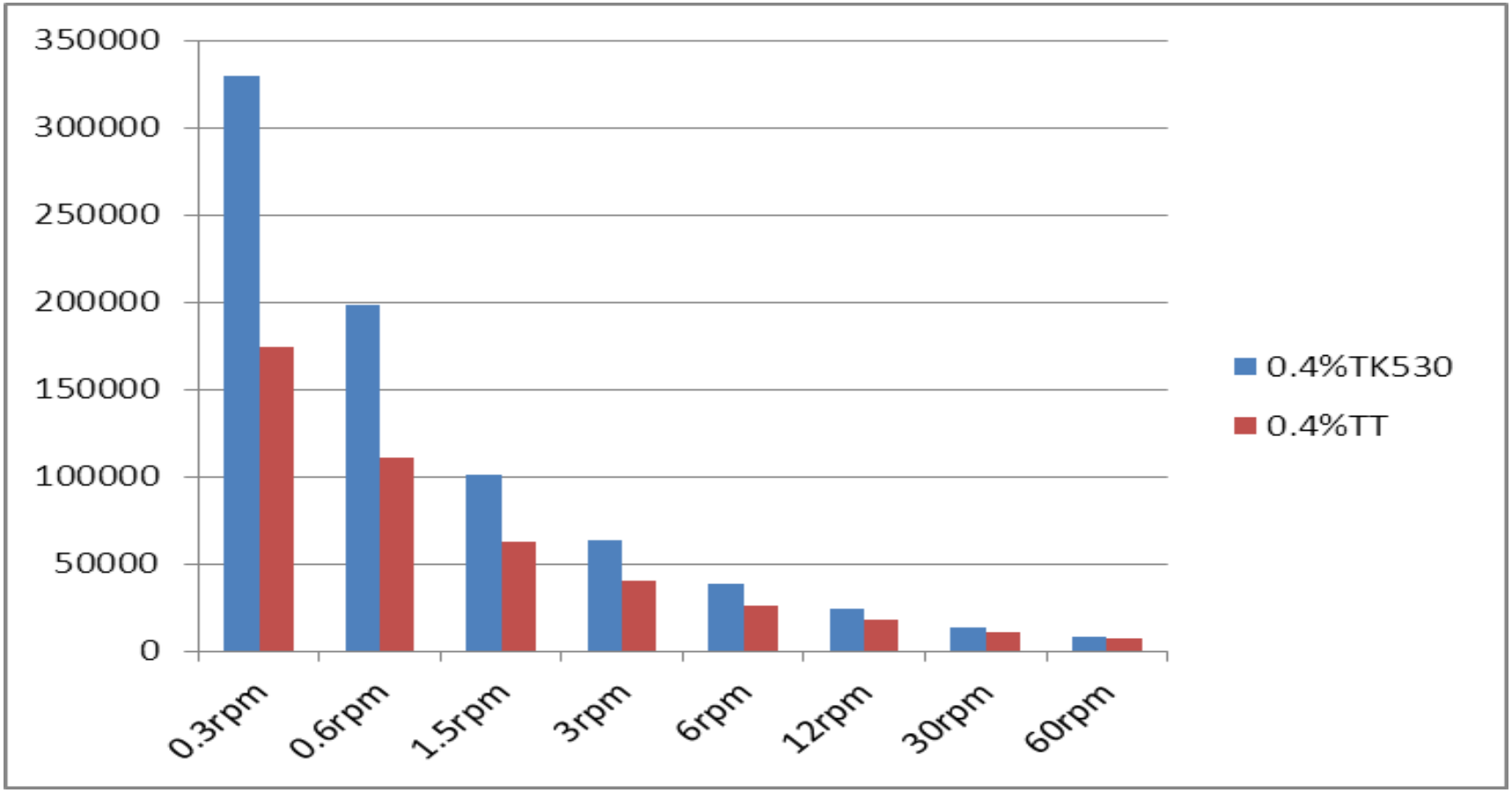


Comparison of thickener in 40%PVC paint
增稠剂在40%PVC涂料中的比较

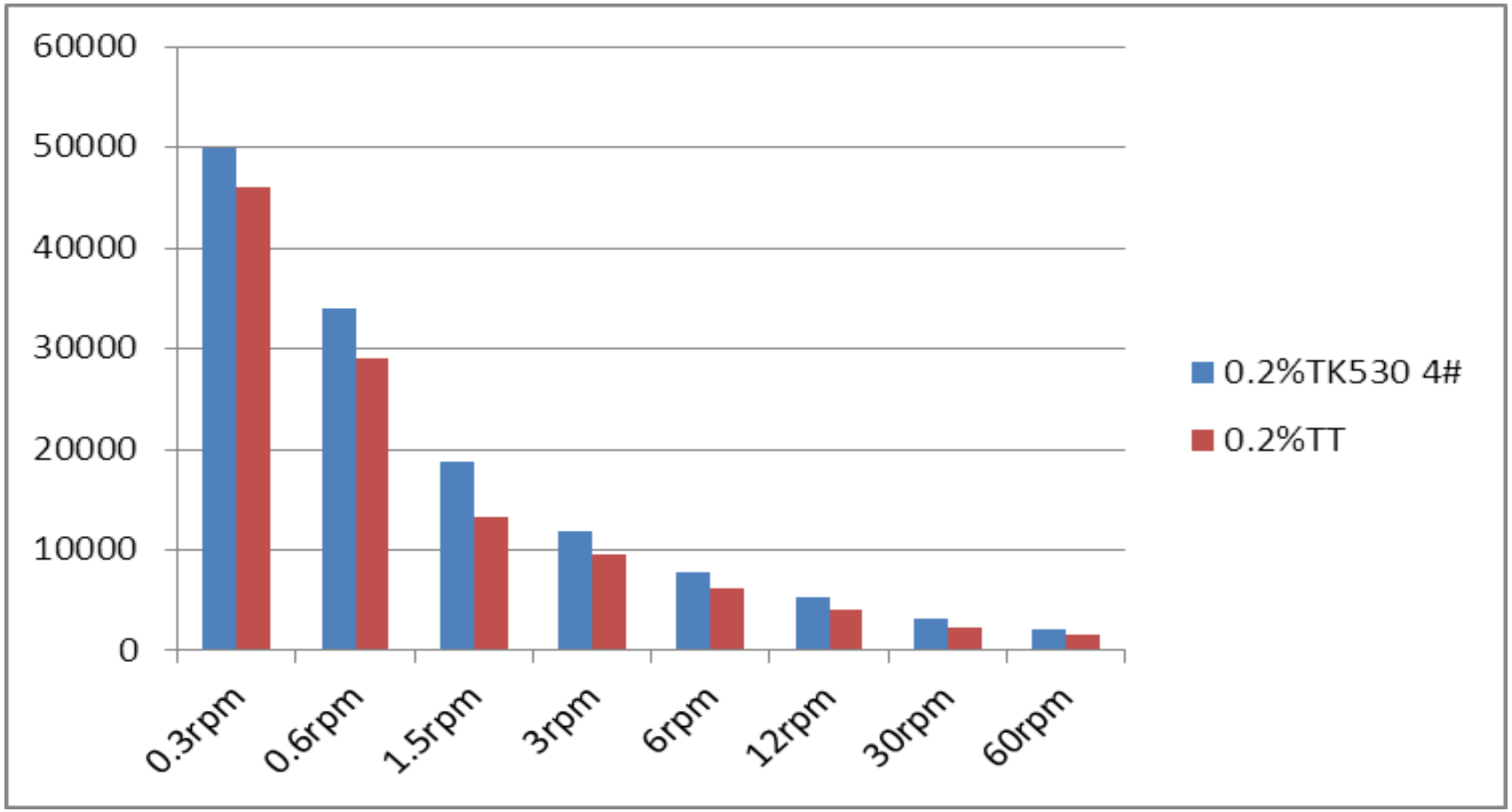
Clariant
Exactly your chemistry.

40%PVC paint based on Mowilith DM 2468 +thickener				
Viscosity (KU)				
	0	0.2%	0.4%	0.6%
TK 530 initial	65	72.8	88.2	93
TK 530 after 24h		82.2	94.6	103
VISC increase		9.4	6.4	10
TT initial		71.4	77	84.3
TT after 24h		75.6	82.8	91.5
VISC increase		4.2	5.8	7.2

Comparison of thickener in 40%PVC paint
增稠剂在40%PVC涂料中的比较

Clariant
Exactly your chemistry.

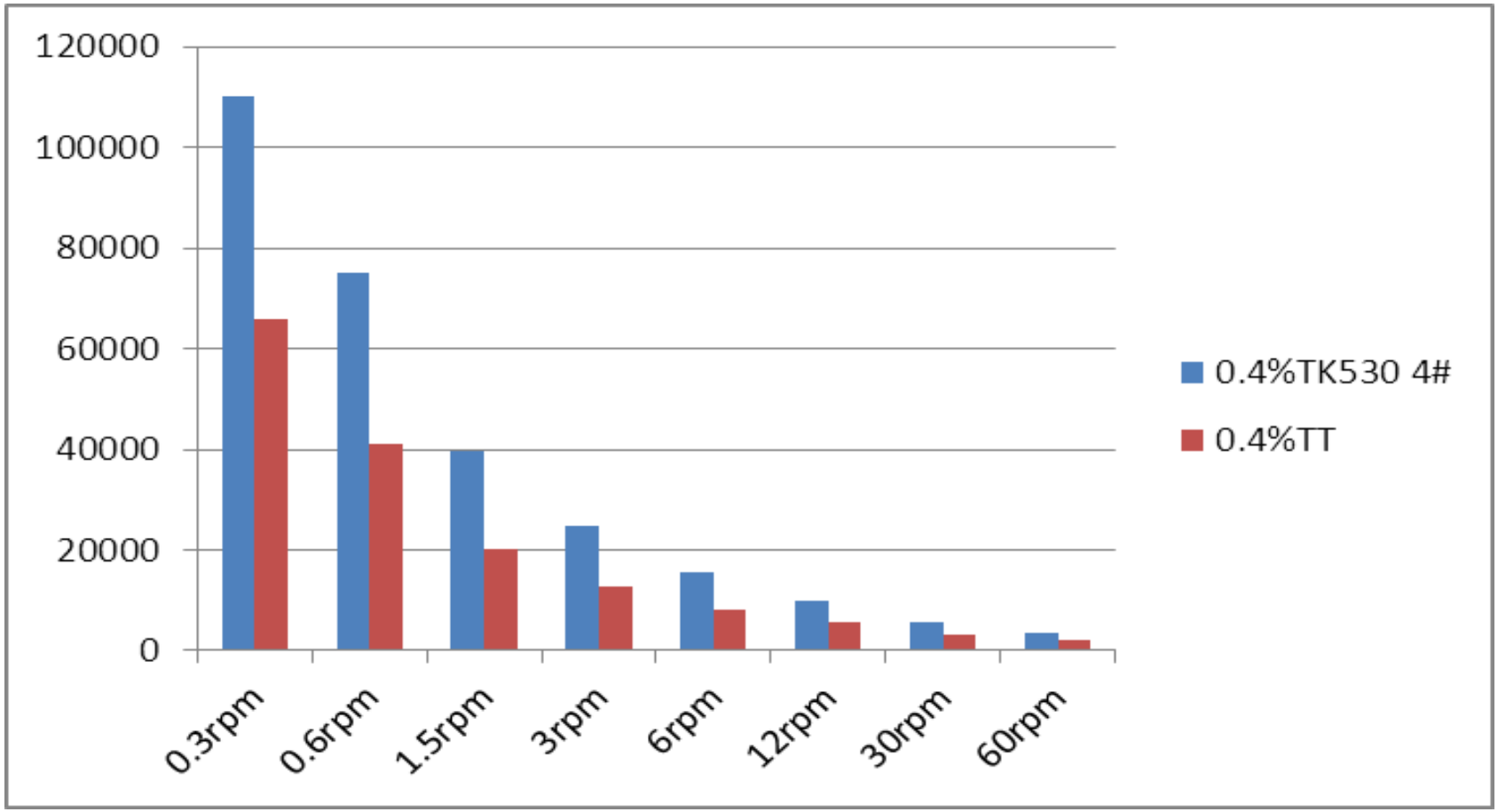
40%PVC paint based on Mowilith DM 2468(VAM / VeoVa), Brookfield DV-I+, LV spindle 4#



Comparison of thickener in 40%PVC paint
增稠剂在40%PVC涂料中的比较

Clariant
Exactly your chemistry.

40%PVC paint based on Mowilith DM 2468(VAM / VeoVa), Brookfield DV-I+, LV spindle 4#



Comparison of thickener in emulsion
增稠剂对乳液的增稠效果比较

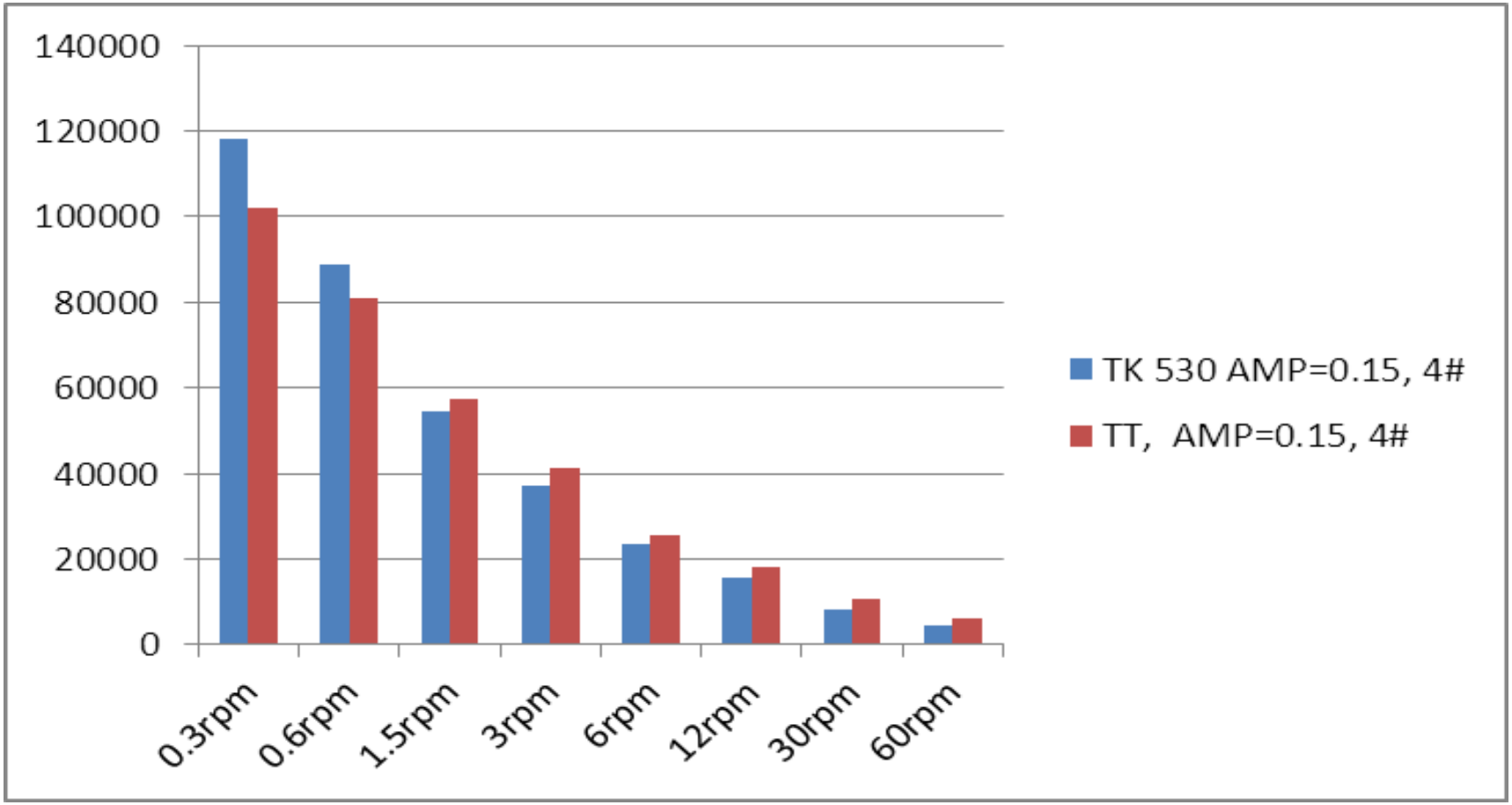
Clariant
Exactly your chemistry.

	200g mixture of Mowilith 6710:water=1:1, add thickener 1g					
	AMP 95	0	0.15	0.3	0.45	0.8
TK 530	PH	7.2	8.1	8.6	9.0	9.5
	Initial (KU)	56.2	77.2	74.4	58.6	51.5
	After 24h(KU)		87	84.5	69.7	52.7
	Visc increase(KU)		9.8	10.1	11.1	1.2
TT	PH	7.2	7.8	8.6	9.0	9.7
	Initial (KU)	86.3	90.5	82.5	61	50.3
	After 24h(KU)		93.3	87.2	67.5	50.9
	Visc increase(KU)		2.8	4.7	6.5	0.6

Comparison of thickener in emulsion
增稠剂对乳液的增稠效果比较

Clariant
Exactly your chemistry.

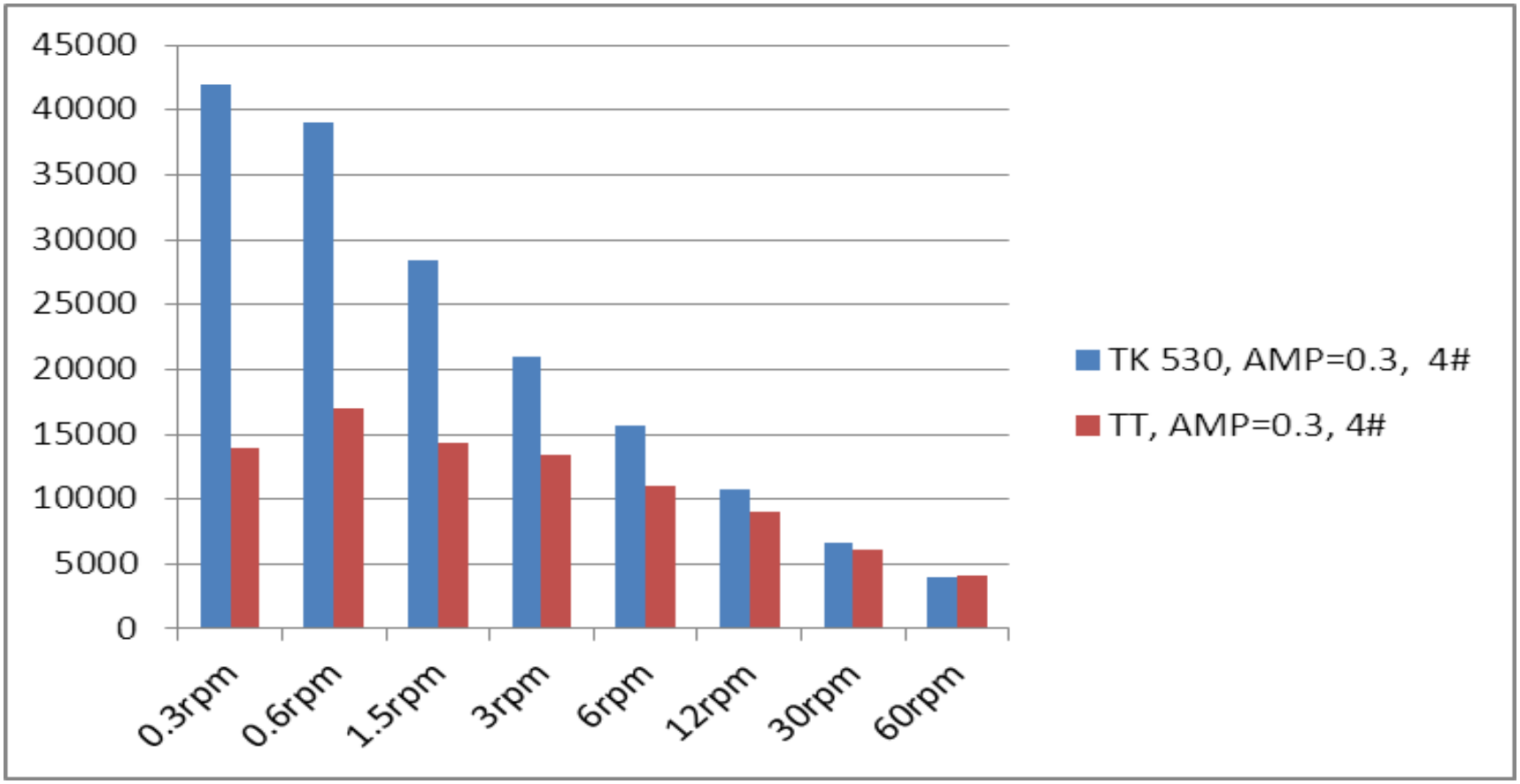
For Mowilith 6710(S/A)



Comparison of thickener in emulsion
增稠剂对乳液的增稠效果比较

Clariant
Exactly your chemistry.

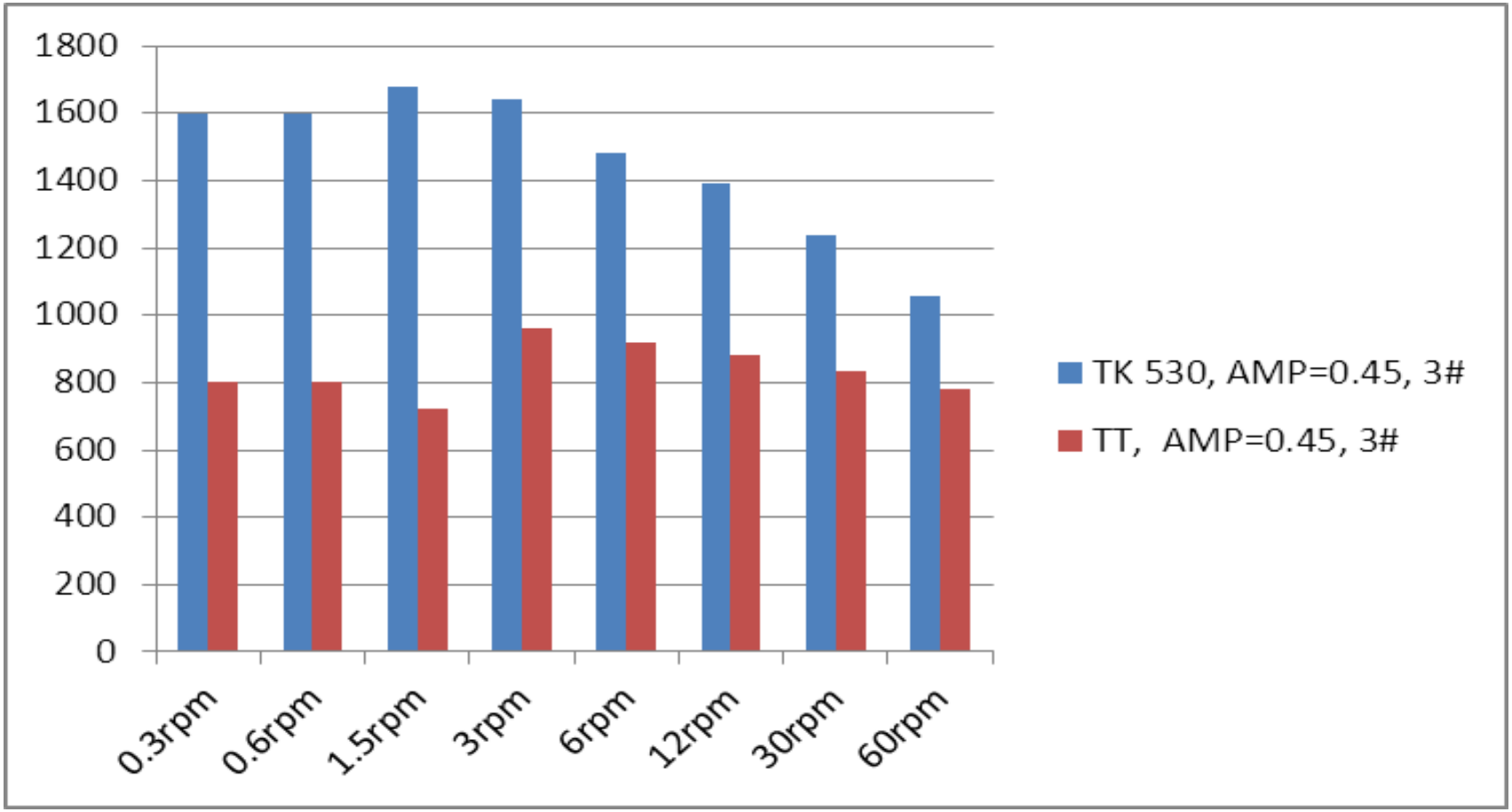
For Mowilith 6710(S/A)



Comparison of thickener in emulsion
增稠剂对乳液的增稠效果比较

Clariant
Exactly your chemistry.

For Mowilith 6710(S/A)



Comparison of thickener in emulsion
增稠剂对乳液的增稠效果比较

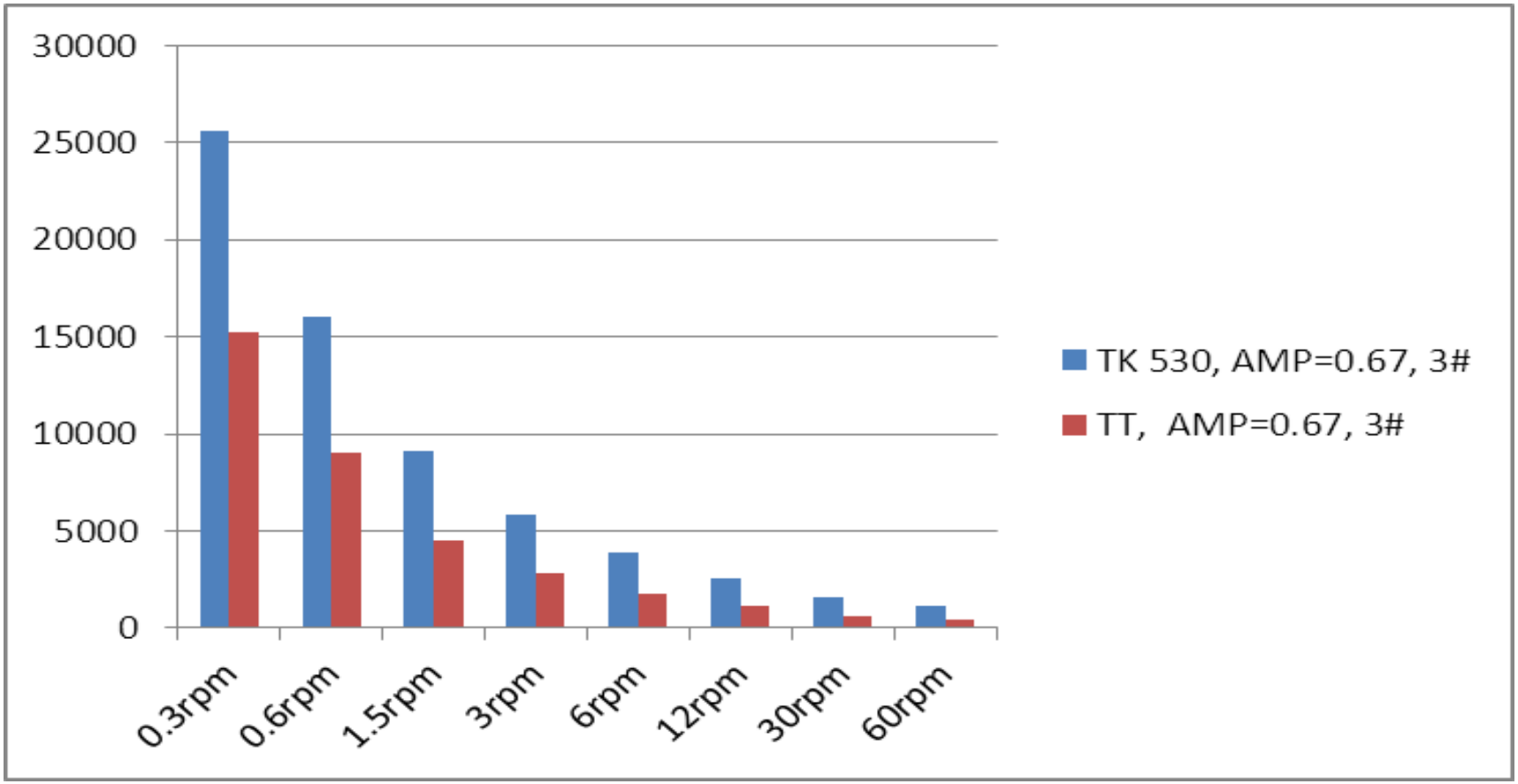
Clariant
Exactly your chemistry.

200g mixture of Mowilith DM 2468:water=1:1, add thickener 4g					
	AMP 95	0.5	0.67	1	1.77
TK 530	PH	7	8	9.7	10.4
	Initial (KU)	63	65.9	67.5	65.7
	After 24h(KU)	70.1	72.2	72.2	69.7
	Visc increase(KU)	7.1	6.3	4.7	4
TT	PH		7.3		10.2
	Initial (KU)		57		56.7
	After 24h(KU)		57.6		57.3
	Visc increase(KU)		0.6		0.7

Comparison of thickener in emulsion
增稠剂对乳液的增稠效果比较

Clariant
Exactly your chemistry.

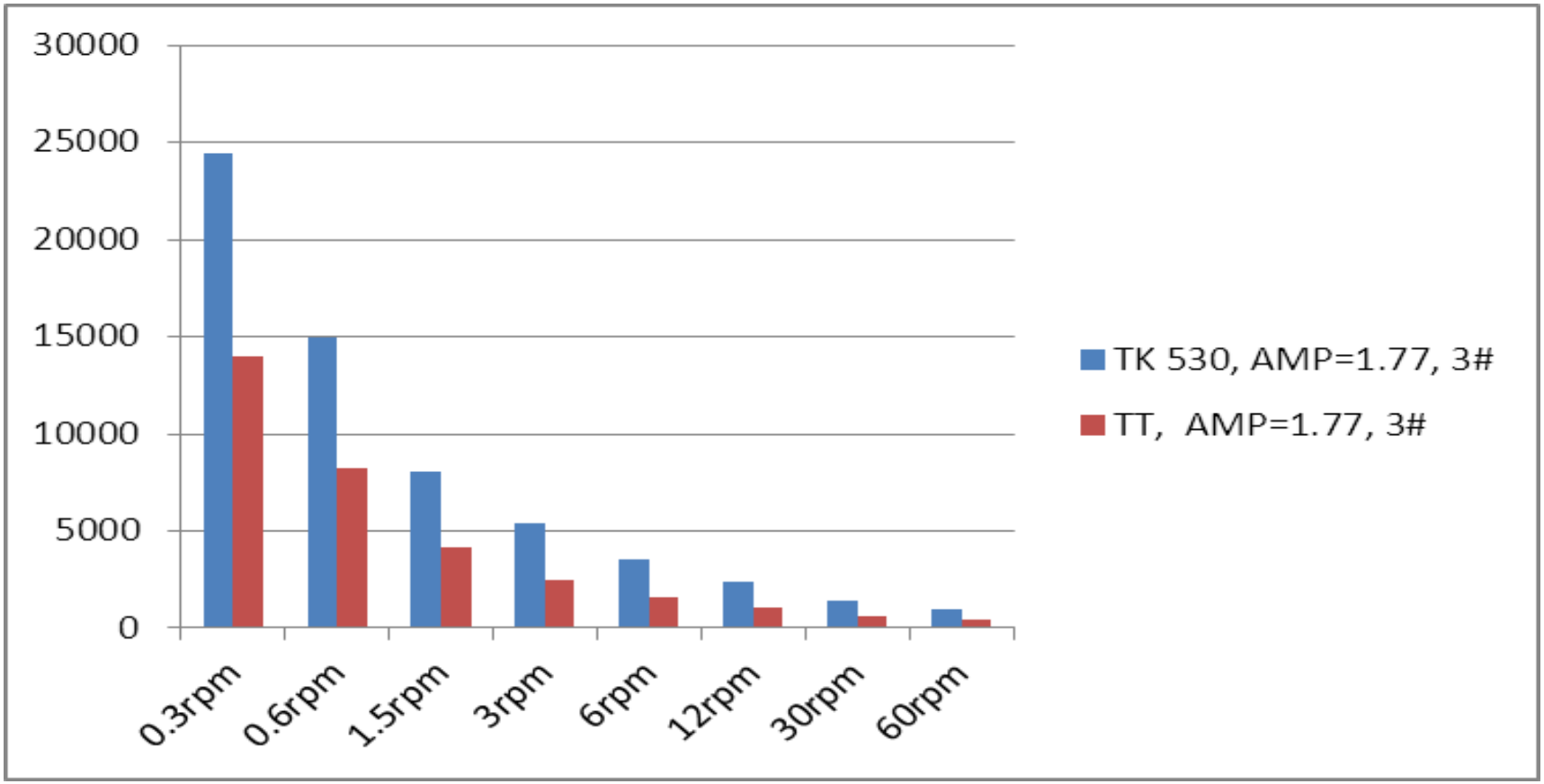
For Mowilith DM 2468 (VAM / VeoVa)



Comparison of thickener in emulsion
增稠剂对乳液的增稠效果比较

Clariant
Exactly your chemistry.

For Mowilith DM 2468 (VAM / VeoVa)



Comparison of thickener in emulsion
增稠剂对乳液的增稠效果比较

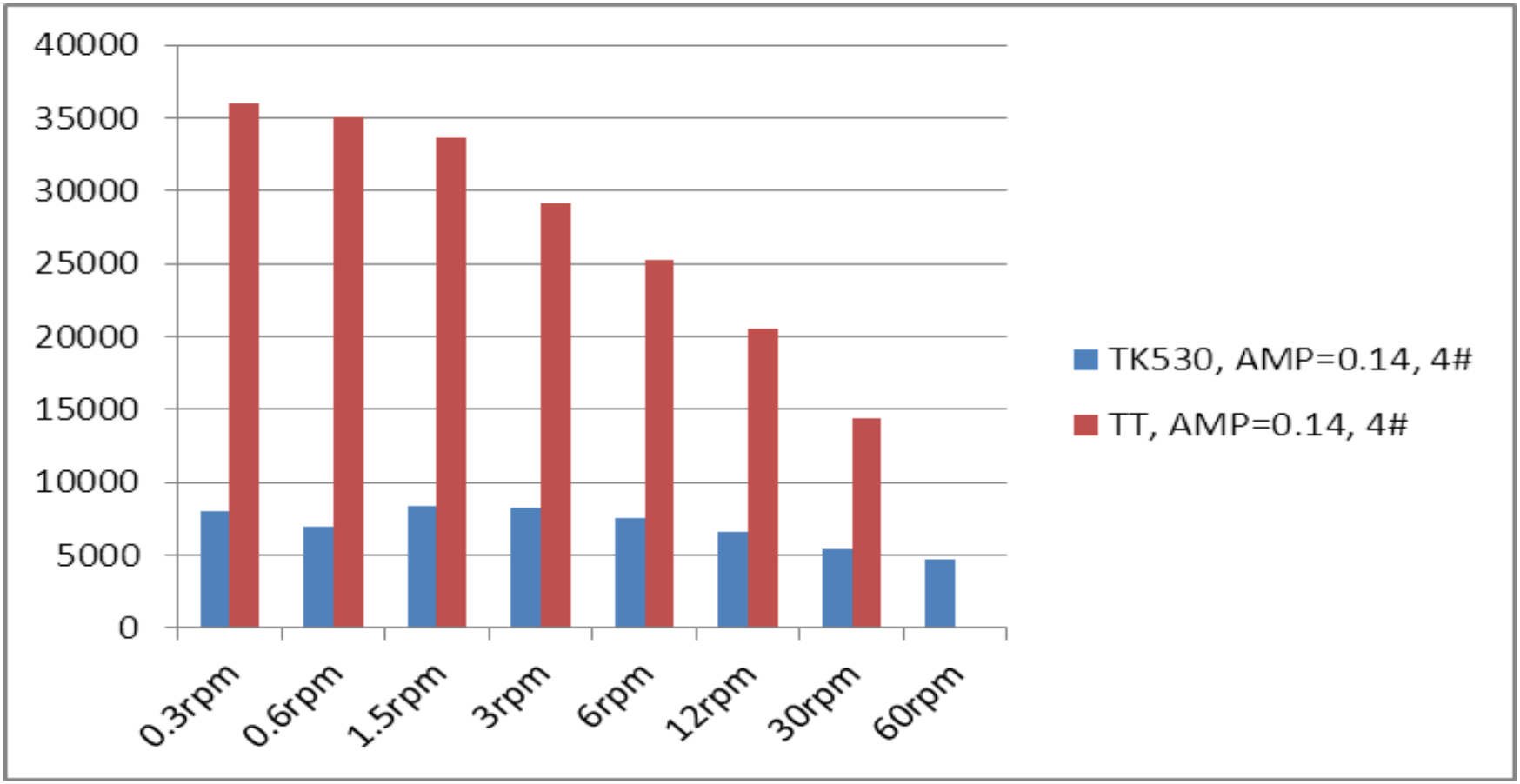
Clariant
Exactly your chemistry.

	200g mixture of Mowilith 727M:water=1:1, add thickener 3g					
	AMP 95	0	0.14	0.22	0.39	0.6
TK 530	PH	6.6	7.1	7.3	8.0	9
	Initial (KU)	93	97.5	87.2	64.5	62.8
	After 24h(KU)		107.5	91.8	66.8	65
	Visc increase(KU)		10	4.6	2.3	2.2
TT	PH	6.5	6.9	7.1	7.7	8.7
	Initial (KU)	103.4	107.5	101.4	62.4	52.1
	After 24h(KU)		128	113.4	63.8	57.4
	Visc increase(KU)		20.5	12	1.4	5.3

Comparison of thickener in emulsion
增稠剂对乳液的增稠效果比较

Clariant
Exactly your chemistry.

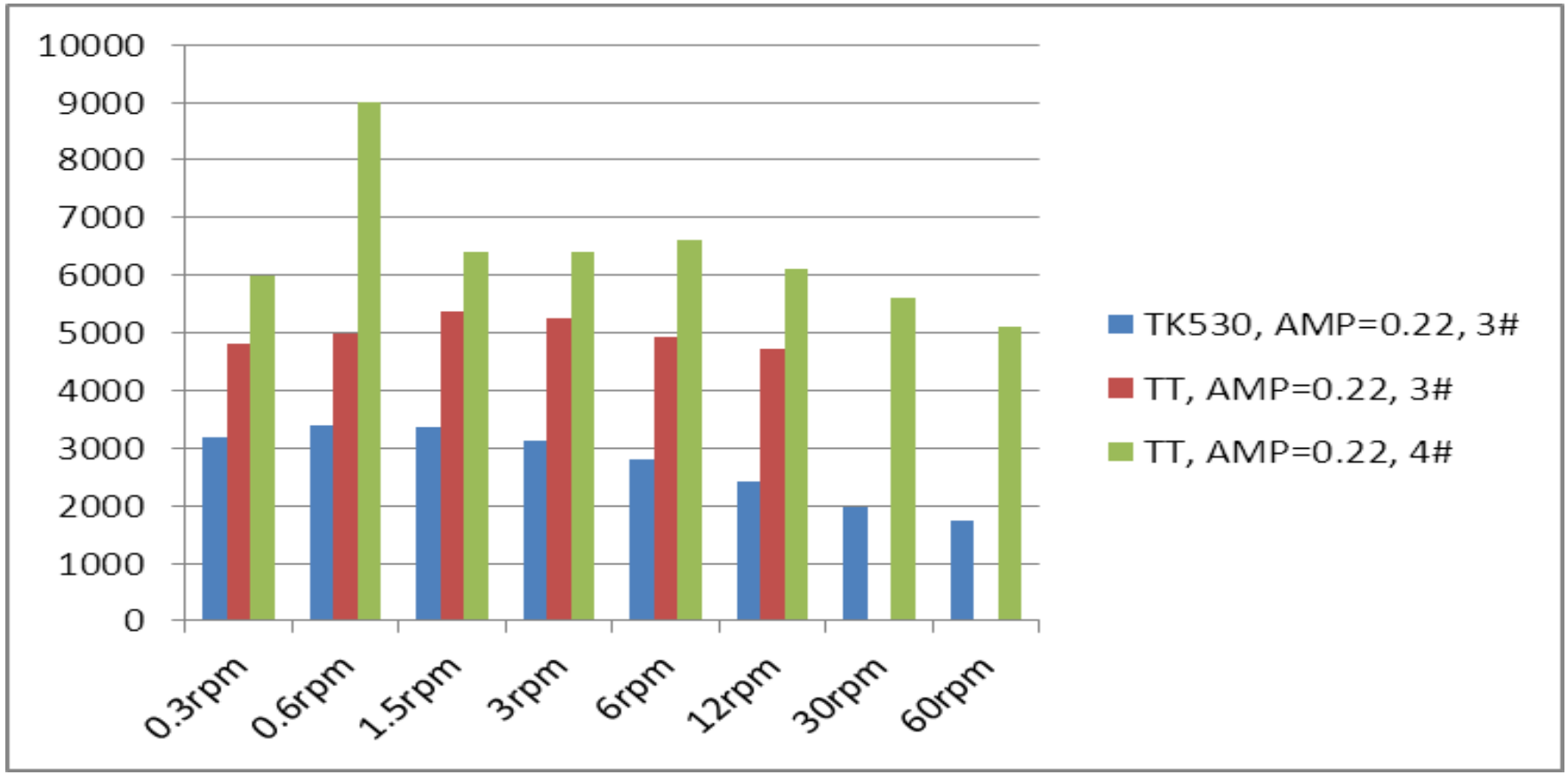
For Mowilith 727M (AA)



Comparison of thickener in emulsion
增稠剂对乳液的增稠效果比较

Clariant
Exactly your chemistry.

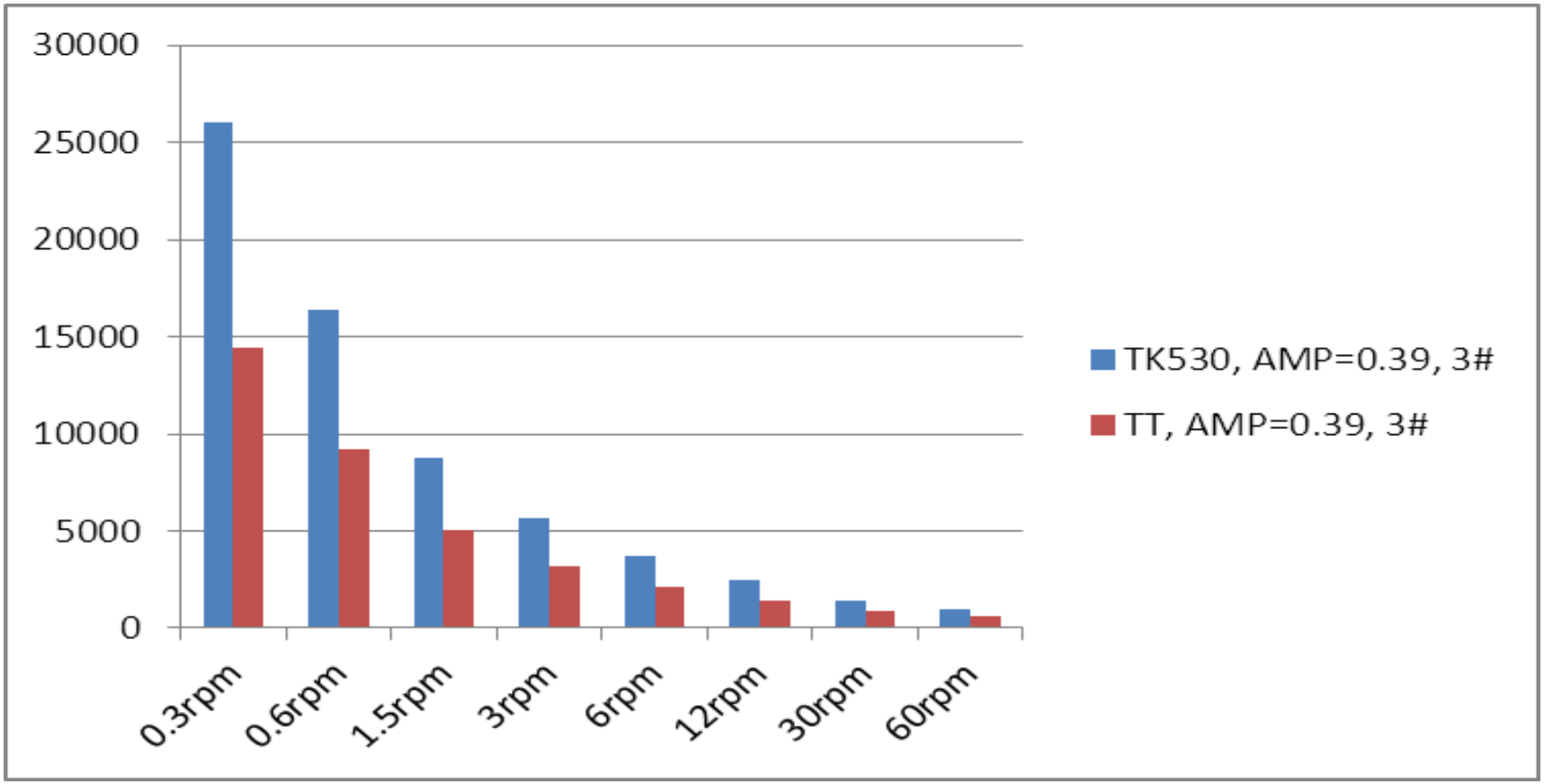
For Mowilith 727M (AA)



Comparison of thickener in emulsion
增稠剂对乳液的增稠效果比较

Clariant
Exactly your chemistry.

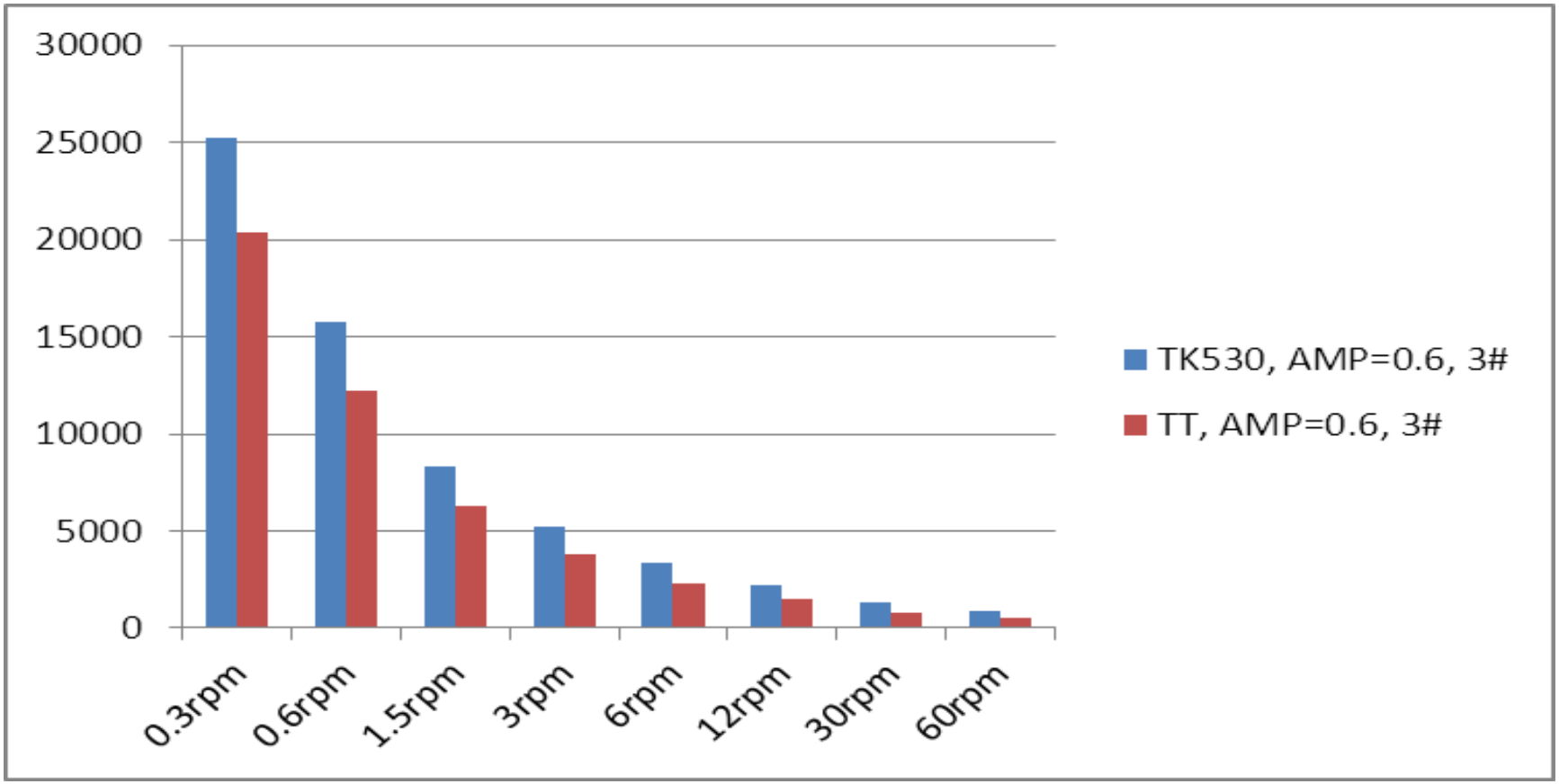
For Mowilith 727M (AA)



Comparison of thickener in emulsion
增稠剂对乳液的增稠效果比较

Clariant
Exactly your chemistry.

For Mowilith 727M (AA)



Comparison of thickener TK 530 and TT—Conclusions
增稠剂TK 530和TT的比较—结论

Clariant
Exactly your chemistry.

- Thickener TT can replace by Mowiliplus TK 530 although there are a little difference in thickening effect for paints and emulsions.
- 通过在不同PVC涂料及不同乳液类型中的比较可以看出，增稠剂Mowiplus TK 530和增稠剂TT虽然在增稠效率和流变特性方面稍有不同，但总体接近，因此，Mowiliplus TK 530可以替代增稠剂TT。