

Colloidal Silica dispersed in Organic Solvents

# ORGANO SILICASOL

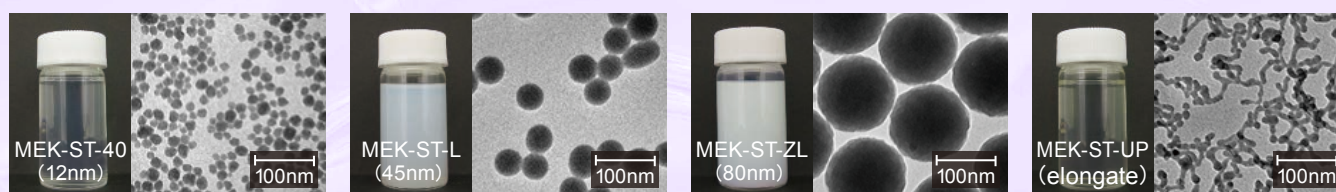
Transparency / Hardness / Anti-block

## Surface treatment variation

Particle size		Solvent	MEK	MIBK	PGME
12nm	Regular		MEK-ST-40	MIBK-ST	PGM-ST
	Methacryl silane		MEK-AC-2140Z	MIBK-AC-2140Z	PGM-AC-2140Y
	Epoxy silane		MEK-EC-2430Z <b>NEW</b>	MIBK-EC-2430Z <b>NEW</b>	—
	Hydrophobic		MEK-EC-2130Y	—	—
45nm	Regular		MEK-ST-L	MIBK-ST-L	—
	Methacryl silane		MEK-AC-4130Y	MIBK-SD-L	PGM-AC-4130Y
80nm	Regular		MEK-ST-ZL	—	—
	Methacryl silane		MEK-AC-5140Z	—	—
	Epoxy silane		MEK-EC-5430Z <b>NEW</b>	—	—
Elongate (chain)	Regular		MEK-ST-UP	—	PGM-ST-UP

\*Other solvents and monomer dispersion are available.

## Appearance



## Coating property

### Acrylic hard coating

Grade	P-hardness	Abrasion (Scratches)	Haze
PGM-AC-2140Y (12nm)	3H	0	0.5%
Only resin	H	2	0.5%

Substrate : PET (125 $\mu$ m)  
 Thickness : 5 $\mu$ m  
 SiO<sub>2</sub> : 30phr  
 Resin : Urethan acrylate  
 Abrasion :  $\Phi$ 27mm, 500g load x 100times; number of scratch

**Enhanced hardness by acrylic functionalized silicasol**

### Anti-blocking



Substrate : PET (125 $\mu$ m)  
 Thickness : 2.5 $\mu$ m  
 Silica sol : MEK-ST-ZL  
 SiO<sub>2</sub> : 5phr  
 Resin : DPHA

**Enhanced Anti-block property with silica sol**

### Epoxy hard coating property

Grade	MEK-EC-2130Y	MEK-EC-2430Z	MEK-EC-5430Z	No silica [Ref.]
Particle size (nm)	12	12	80	—
Surface treatment	Non-reactive	Reactive (Epoxy)	Reactive (Epoxy)	—
SiO <sub>2</sub> content (phr)	50	50	50	0
Pencil hardness	3H	3-4H	4H	2H
Anti-abrasion*	30 $\leq$	15	3	30 $\leq$
Haze (%)	0.5	0.5	0.7	0.6
Flex resistance (mm $\Phi$ )	5	5	5	5

Resin: Celloxide 2021P, Hardener: CPI-101A,  
 Substrate: PET(125 $\mu$ m), Coating thickness: 5 $\mu$ m  
 \*300g load  $\times$  100 times, number of scratch

**Enhanced hardness by epoxy functionalized silica sol**

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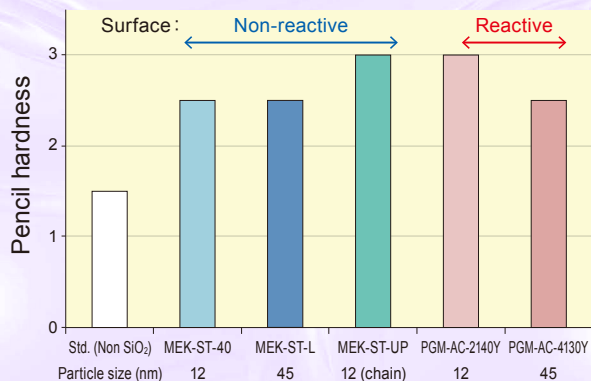
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## — Coating performance —

### Pencil hardness -Urethane acrylate

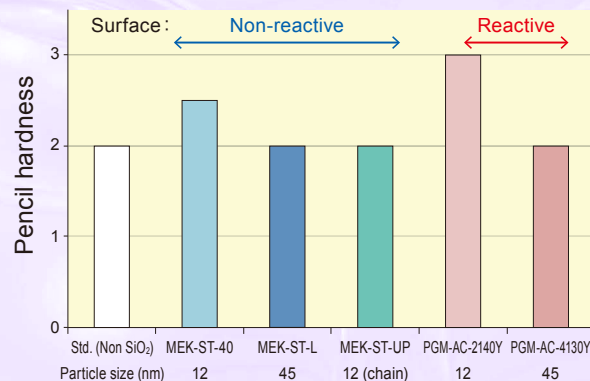
Substrate : PET125 $\mu$ m, Coating thickness : 5 $\mu$ m,  
Resin : UA-306H, SiO<sub>2</sub> : 30phr



Regardless of surface reactivity, pencil hardness increased by adding silica sol in case of urethane acrylate formulation.

### Pencil hardness -DPHA

Substrate : PET125 $\mu$ m, Coating thickness : 5 $\mu$ m,  
Resin : DPHA, SiO<sub>2</sub> : 30phr



Reactive functional group treated small particle (PGM-AC-2140Y) increased pencil hardness for DPHA formulation.

### Performance by silica sol grades

Grade	Particle size (nm)	Surface treatment	Haze	Pencil hardness	Anti abrasion	Curl prevention	Flex resistance	Hydrophilicity	Anti-block
PGM-ST	12	—	Not good	Good	Poor			Very Good	
MEK-ST-40	12	Non-reactive	Good	Good	Not good	Very Good	Good	Fair	
MEK-ST-L	45		Good	Good	Fair	Good	Good	Fair	Good
MEK-ST-ZL	80		Good	Good	Fair	Fair	Good	Fair	Very Good
MEK-ST-UP	Chain		Good	Good	Fair	Fair	Good	Fair	
PGM-AC-2140Y	12	Reactive	Good	Very Good	Fair	Not good	Poor	Fair	
PGM-AC-4130Y	45		Fair	Good	Fair	Not good	Poor	Fair	
MEK-AC-5140Z	80		Fair	Good	Fair	Fair	Fair	Fair	

Very good > Good > Fair > Not good > Poor  
(Better than standard) (= standard) (poorer than standard)

### Compatibility between pencil hardness and curl

Resin	Nano silica				Evaluation result			
	Grade-1 (non-reactive)	phr	Grade-2 (reactive)	phr	Haze	Pencil hardness	Anti-abrasion	Curl (mm)
DPHA	—	0	—	0	0.4	2H	Good	21
	MEK-ST	100	—	—	0.4	2.5H	Poor	12
	—	0	PGM-AC-2140Y	100	0.4	3H	Good	21
	MEK-ST	67	PGM-AC-2140Y	33	0.4	3H	Good	15

Initiator : Irgacure-184 : 5phr, Solvent : PGME,  
Substrate : PET; 125 $\mu$ m, Coating thickness :  $\approx$ 5 $\mu$ m,  
Dried condition : 60°C x 3min, UV-cure : 1000mJ/cm<sup>2</sup>,  
Abrasion resistance : 500g load x 100 times,  
[Anti-abrasion result] Good : No scratch,  
Fair : <10 scratches, Poor :  $\geq$ 10 scratches

- Non-reactive; good curl prevention but poor anti-abrasion.
- Reactive; poor curl prevention but good anti-abrasion.
- Combined 2 grades fulfill good hardness with low curl.

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