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PhireGuard SilGuard

2018 Yoke New Materials

Yoke New Materials

April 3, 2018

Introducing a new range of Silicone Surfactants for PU Foams

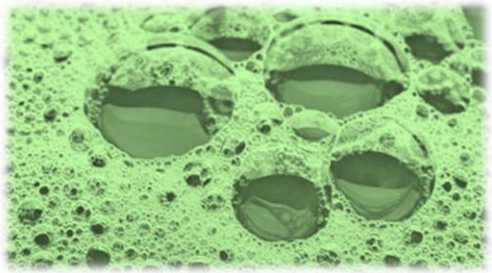
Silicone Surfactants

- Jiangsu Yoke Technology Co. Ltd has reinvigorated its efforts toward the production and marketing of silicone surfactants to be used in polyurethane foam materials.
- A new family of products has been developed that is being commercialized worldwide
- The Yoke silicone surfactants family of products is called:

SilGuard

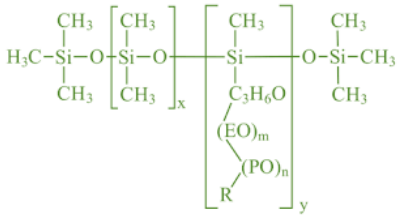
Silicone in General_1

- Silicone surfactants are used in the manufacture of polyurethane foams and play two major functions:
  - They help mixing and homogenizing the various chemicals utilized
  - They stabilise the reacting and rising the reacting foam structure until sufficient polymerization and network formation has occurred within the polyurethane architecture.
- In brief, Silicones surfactants influence the emulsification of the raw materials mixture, the appearance of Air / CO2 bubbles (nucleation process), the stabilization of the rising foam and finally the degree of cell-opening desired at the reaction end.



Silicone in General_2

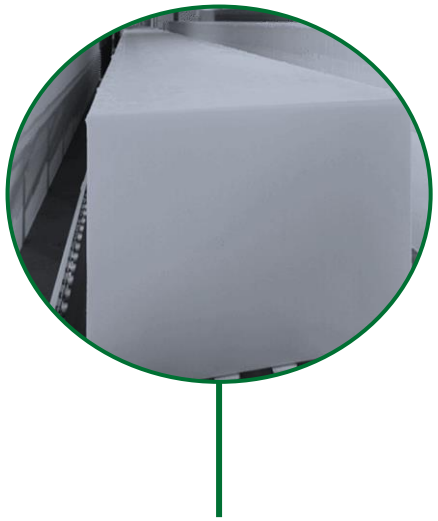
- Silicone surfactants are primarily polysiloxane-polyoxyalkylene comb-like block copolymers.
- This structure allows the tuning of various molecular parameters to obtain the desired surfactant effect:
  - Total molecular weight, ratio polysiloxane / polyoxyalkylene, PO/EO ratio in the polyoxyalkylene side chains, terminal group of the polyoxyalkylene chains, number of polyoxyalkylene side chains alongside the polysiloxane backbone, nature of the bond between the two constitutive polymers (Si-O-C: hydrolysable surfactant, Si-C: non-hydrolysable)
  - A specific combination of above parameters is needed to insure optimal results in either flexible foam (conventional, viscoelastic, high resilience...) or rigid foam.



Range at a Glance

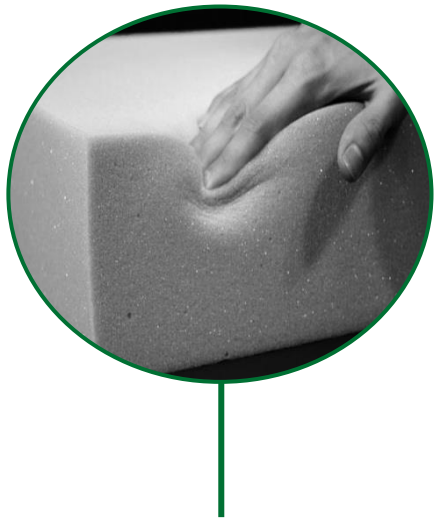
SilGuard

Slab Flexible Polyether



YK-1101
YK-1102

HR Molded



YK-1211
YK-1212

Viscoelastic

YK-1301

Rigid

YK-2101
YK-2102

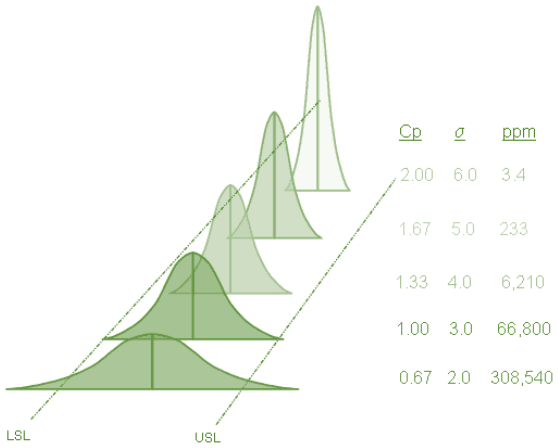
More Details

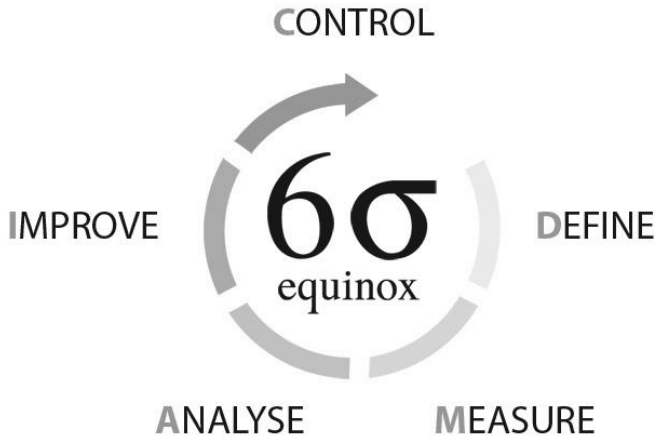
- SilGuard YK-1101: non hydrolizable silicone for the production of low density slabstock polyether foam. Great compatibility with ABA's.
- SilGuard YK-1102: Broad process latitude silicone for the production of slabstock polyether foam of any density.
- SilGuard YK-1211: Low VOC's silicone for the production of TDI/MDI blended high resilience foam.
- SilGuard YK-1212: Low VOC's silicone for the production of MDI-based high resilience foam.
- SilGuard YK-1301: Silicone designed for the production of low-middle density viscoelastic foam. Compatible with both TDI and MDI technologies.
- SilGuard YK-2101: Ubiquous non-hydrolizable silicone for the production of rigid foam.
- SilGuard YK-2102: Non-hydrolizable silicone for the production of rigid foam. Great compatibility, in particular with cyclopentane blowing technology. Yields low K-factor.

Quality Consistency

- In view of the paramount role played by silicone surfactants during the manufacturing of polyurethane foams, a rigorous control of quality and quality consistency is absolutely required to prevent variations.

- At Yoke, we applied 6-sigma process control methodology





SilGuard Process Performance

Where Cpk is the process Capabilty Index,σ the standard deviation, the average, USL the upper specification limit and LSL the lower specification limit.

$$Cpk = \min\left[\frac{(USL-\mu)}{3\sigma}, \frac{(\mu-LSL)}{3\sigma}\right]$$

$$\mu = \frac{\sum_i P_i}{i} \qquad \sigma = \sqrt{\frac{1}{N}\sum_i^N (P_i-\mu)^2}$$

- Wheres Cpk analyses the variation of one property amongst a collection of batches, we also record a quality index for every batch, i.e. a theoretical quality index Qi of 100 would correspond to a batch having a measured property in the middle of the spec range (for instance the viscosity), or a measure property of zero for one sided property (for instance Acid Value).

$$P_i = 1 - \frac{\left|P_{measured} - P_{target}\right|}{P_{range}}$$

$$Q_i = 100 * \frac{\sum_i P_i}{i}$$

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SilGuard Process Performance

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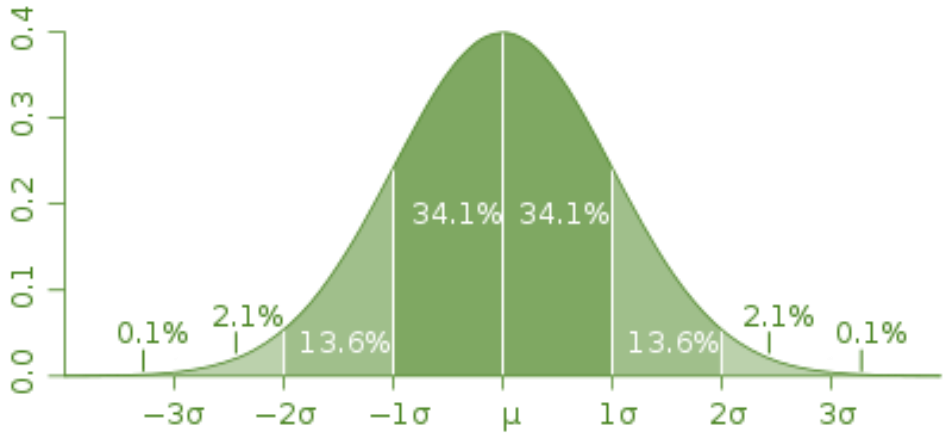
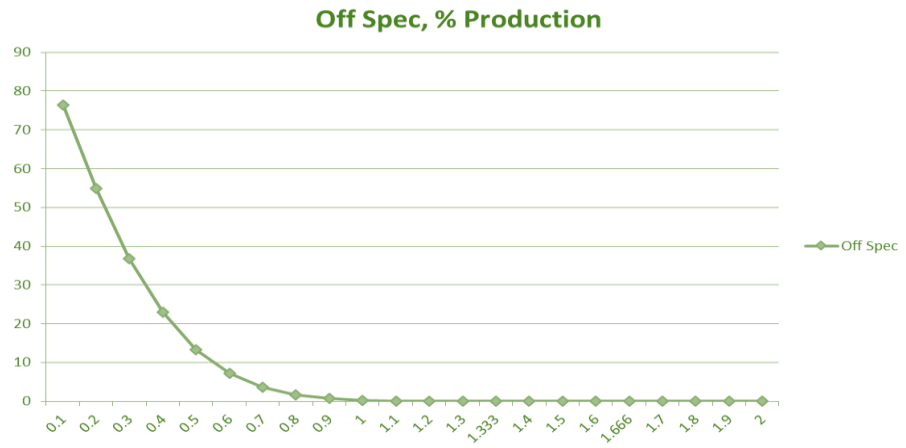
- The 6-Sigma concept:



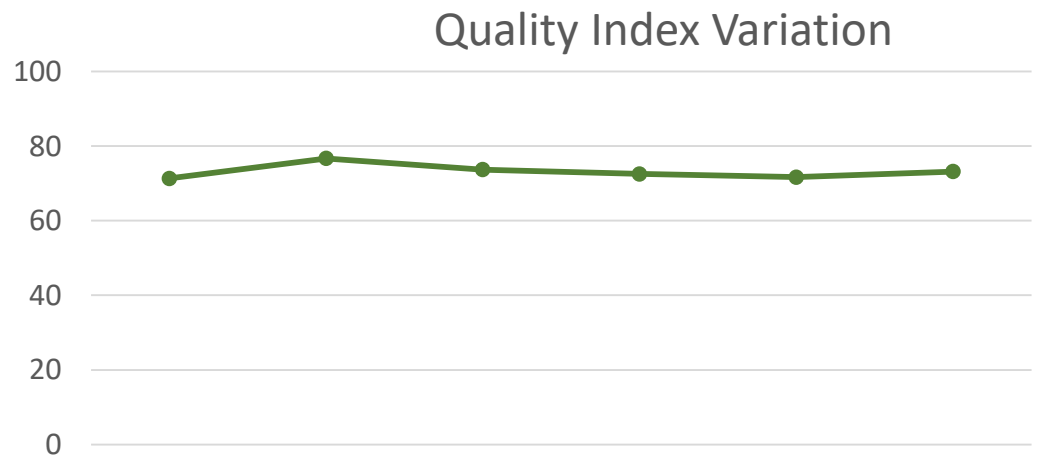
- Cpk (Process capability): the greater the Cpk, the narrower the distribution around μ, the lesser the off-spec production for a given property.



SilGuard YK-1101

Property	Average, μ	St Deviation, σ	Cpk
pH	4.918	0.019	87.28
Viscosity @ 25C, mPa.s	1135	8	2.59
Water Content, %wt	0.113	0.01	2.80
Specific Gravity @ 25C	1.022	0.005	8.03

- Quality Index Consistency



In Summary

- Yoke is launching a new breed of Silicone Surfactants for Polyurethane foam within its Yoke New Materials business unit.
- Focus has been placed on Innovation and Quality Consistency
- The offer and number of grades is likely to grow in the near future
- The SilGuard grades are available worldwide

SilGuard