

VORASURF™ Silicone Polyurethane Additives

Discontinuous Flex Foaming

The requirements for a surfactant for discontinuous boxfoaming are different from continuous processing. Box foam processing has, in general, poor mixing of the polyol, isocyanate and additives, requiring a stronger emulsification power from the silicone. Also, dissipation of the heat of reaction in discontinuous processing is harder on the surfactant, potentially causing splits as the foam cures. Even more challenging conditions occur if the foam is produced in cylinder shaped boxes, where a fine cell structure and a good density distribution are key for post-processing.

In addition, finely divided inert inorganic fillers are often purposely used in the formulation, such as CaCO₃ and PET (polyethylene terephthalate). Mainly, the post-consumer PET is obtained from recycled plastic, micronized to a particle size up to 300µm. In low concentration (1.5 pph), PET has been shown to act as a reinforcement additive, potentially enhancing properties like tear and tensile resistance; however, a high load of PET (20.0 pph) is often used to reduce cost, requiring specific surfactants with a balanced stabilization and cell opening effect.

Table 1: Formulations tested in plant trials

		Rectangular		Cylindrical
		20 kg/m ³	45 kg/m ³ with filler	20 kg/m ³
Silicone	VORASURF™ DC 5933 Additive	✓	–	–
	VORASURF™ DC 5906 Additive	✓	✓	✓
	VORASURF™ DC 5986 Additive	✓	–	✓
Formulation (pph)	VORANOL™ WL 4010 Polyol	100	0	0
	VORANOL™ 3011 Polyol	0	78	69
	VORANOL™ 3943A Polyol	0	22	31
	Silicone	1.2	0.8	1.0
	PET	0	21	0
	Water	4.15	3.5	2.3
	Methylene chloride	3.62	0	2.4
	Amine catalyst	0.18	0.15-0.25	0.12-0.25
	Tin catalyst	0.19	0.15-0.20	0.15-0.20
	TDI	57.69	34.8	40.2
Mix	1st – amine + silicone + water	600 rpm / 30s	600 rpm / 30s	700 rpm / 40s
	2nd – tin	600 rpm / 35s	650 rpm / 40s	750 rpm / 40s
	3rd – TDI	700 rpm / 5s	900 rpm / 5s	1000 rpm / 6s

✓ = Attribute present in product – = Attribute absent in product

Discontinuous process is viable for low-volume specialty grades and, in developing countries, is a common approach to produce conventional flexible. VORASURF™ Silicone Polyurethane Additives has been extensively tested with excellent results in plant trials. Some of the latest results combining our silicones with VORANOL™ Polyether Polyols can be found in tables one through four.

For more information on VORASURF™ Silicone Polyurethane Additives, contact your Dow representative or visit www.dow.com.

Table 2: Rectangular box foam performance

Surfactant	Fine cell structure	Cell opening	Block height
VORASURF™ DC 5933 Additive	**	**	**
VORASURF™ DC 5906 Additive	**	***	**
VORASURF™ DC 5986 Additive	**	*	***
Competitor 1	***	*	**
Competitor 2	**	**	***

Table 3: Rectangular box foam performance with filler

Surfactant	Fine cell structure	Cell opening	Block height
VORASURF™ DC 5906 Additive	**	***	**
Competitor 3	**	**	**

Table 4: Cylindrical box foam performance

Surfactant	Fine cell structure	Cell opening	Block height
VORASURF™ DC 5906 Additive	**	***	**
VORASURF™ DC 5986 Additive	***	**	**
Competitor 1	**	**	**
Competitor 4	***	**	***

* = Low performance ** = Moderate performance *** = High performance

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