Kemgard™

Flame Retardant · Smoke Suppressant

Kemgard HPSS

New Product Advisory

SIGNIFICANT IMPROVEMENT IN
SMOKE SUPPRESSION AND DYNAMIC STABILITY
FOR FLEXIBLE PVC SYSTEMS

KEMGARD HPSS

PROVIDES SUPERIOR SMOKE SUPPRESSION

Sherwin-Williams has been providing Kemgard smoke suppressants to the polymer industry for many years. Polymer users are under pressure to provide better flame retardancy and lower smoke for critical applications. Sherwin-Williams has developed a new product to provide these better properties. Kemgard HPSS is the next generation smoke suppressant/synergist for flexible PVC applications such as plenum cable. Kemgard HPSS shows significant reduction in smoke over competitive products.

With Kemgard HPSS in a standard flexible PVC formulation, smoke evolution was measured in the ASTM E662 test. The results are shown below in Table 1.

Table 1. Kemgard HPSS in Flexible PVC Formulation

Component	20 phr AOM	**10 phr Kemgard HPSS**
Oxyvinyl 240	100	100
Halstab H-695	7	7
Antimony Oxide	3	3
ATH 9402	30	40
Santicizer 2148	20	20
Uniplex FRP-45	20	20
NBS Smoke Flaming Mode ASTM E662 D90	56	**33**
ASTM E662 D4	205	**164**
ASTM E662 Dmax	266	**283**

Some manufacturers are using polyolefin additions to PVC to improve the low temperature characteristics of the formulation over those formulations incorporating only phosphate ester and/or brominated plasticizers. The formulation in Table 2 shows the improved ASTM E662 performance provided by Kemgard HPSS when an EVA polymer is used in the system.

Table 2. EVA-PVC Formulation with Kemgard HPSS

Component	Control	AOM	**Kemgard HPSS**
Oxyvinyl 240	100	100	100
Elvaloy	20	20	20
Halstab H-695	7	7	7
Antimony Oxide	2	2	2
ATH 9402	70	50	60
Santicizer 2148	10	10	10
Uniplex FRP-45	30	30	30
$Mg(OH)_2$	10	10	10
AOM		20	
Kemgard HPSS			**10**
NBS Smoke Flaming Mode ASTM E662 D90	25	32	**21**
ASTM E662 D4	219	172	**165**
ASTM E662 Dmax	321	251	**279**

In Tables 1 and 2, the formulations using Kemgard HPSS showed a significant and highly desirable reduction in the ASTM D90 and D4 smoke results over that found when using the competitive and more costly AOM product.

Also, in both cases above, Kemgard HPSS provided flame retardant performance improvement as measured in the LOI (Limiting Oxygen Index) test. In Table 1 above of Kemgard HPSS formulation achieved a LOI of 53 versus 50 for the AOM formulation. In Table 2 above, the Kemgard HPSS formulation achieved a 55+ LOI versus 53 for both the control and AOM formulations.

In recent years, producers and users of smoke suppressant formulations have also been requesting non-lead containing wire and cable systems. Again, Sherwin-Williams has evaluated Kemgard HPSS versus the competition in a typical non-lead formulation. The results are shown in Table 3.

Table 3. Kemgard HPSS in a Non-Lead PVC Formulation

Component	AOM	**Kemgard HPSS**
Oxyvinyl 240	100	100
ATH	60	70
Antimony Oxide	3	3
Baerlocher MC9108KA	7	7
Santicizer 2148	20	20
Uniplex FRP-45	20	20
AOM	20	
Kemgard HPSS		**10**
NBS Smoke Flaming Mode ASTM E662 D90	37	**24**
ASTM E662 D4	171	**107**
ASTM E662 Dmax	224	**201**
LOI	50	**55+**

It is easy to see the superior smoke suppressant and flame retardant performance by Kemgard HPSS in the typical non-lead stabilizer formulation shown above.

KEMGARD HPSS PROVIDES IMPROVED DYNAMIC STABILITY

Processing stability is a major concern of high performance PVC system formulators. Kemgard HPSS has demonstrated stability in excess of the competitive product AOM and is also better than Kemgard 911C in lead and non-lead stabilizer systems. Performance information is shown in Table 4. These evaluations were conducted using a Brabender Plasti-Corder Digi-System equipped with Type 6 Roller Blades (3:2 Speed Ratio).

Table 4. Dynamic Stability of Kemgard HPSS
Lead and Non-lead Stabilizer PVC Systems

	Lead Phthalate Systems					Non-Lead System		
Component	1	2	3	4	5	6	7	8
Oxyvinyl 240	100	100	100	100	100	100	100	100
ATH 9402	60	70	20	20	20	80	60	70
Zerogen 50SP			5	5	5			
Uniplex FRP-45	20	20	20	20	20	20	20	20
Santicizer 2148	32	32	27	27	27	32	32	32
Stearic Acid	1	1	0.3	0.3	1	1	1	1
Lead Phthalate	8	8						
Halthal			8	8	8			
Baeropan MC9108KA						8	8	8
Kemgard 911C	20			20				
AOM			20				20	
Kemgard HPSS		**10**			**10**			**10**
Decomposition Time*	26:24	**1:19:20**	65:12	52:46	**67:44**	38:20	29:12	**48:54**

***Decomposition Time in Hours:Minutes:Seconds. Brabender mixing temp. is 205 ^{o}C and Brabender mixing speed was 100 rpm.**

Note the system shown in columns 1 and 2 compares Kemgard HPSS with Kemgard 911C in a formulation using ATH and lead phthalate. In this system, Kemgard HPSS outperforms Kemgard 911C in dynamic stability.

The system shown in columns 3, 4 and 5 also contains lead phthalate stabilizer and incorporates both ATH and magnesium hydroxide (Zerogen 50SP). This system compares Kemgard HPSS with Kemgard 911C and with AOM. Again, the Kemgard HPSS is the superior performer.

Finally, the system shown in columns 6, 7 and 8 is a non-lead system using ATH and compares Kemgard HPSS with AOM and a control formulation without smoke suppressant. In this case again, Kemgard HPSS is the superior performer.

One significant problem with these highly loaded high performance systems is the stiffness or high flexural modulus of the compounds. Shown in Table 5 is a comparison of Kemgard HPSS and Kemgard 911C in typical flexible PVC formulations evaluated for flexural modulus as well as NBS smoke performance. Flexural modulus was determined on a TA 2980 DMA using the single cantilever mode of deformation.

Table 5. Flexural Modulus of Kemgard HPSS and 911C in Flexible PVC

Component	Kemgard 911C	**Kemgard HPSS**
Oxyvinyl 240	100	100
Lead Phthalate	7	7
Antimony Oxide	3	3
ATH 9402	50	50
Santicizer 2148	20	20
Uniplex FRP-45	25	25
Kemgard 911C	10	
Kemgard HPSS		**10**
NBS Smoke		
D90	49	**22**
D4.0	186	**115**
Dmax	268	**214**
Flexural Modulus		
Mpa @ 0 ^{o}C	6010	**3804**
Mpa @ 25 ^{o}C	2770	**2405**

The flexural modulus for the Kemgard HPSS formulation is lower by over 13% at 25 ^{o}C and is lower by over 36% at 0 ^{o}C. This means that less plasticizer would be needed to achieve the same modulus or that a softer compound could be produced that would perform well at low temperatures. So once again we see the superior performance advantages associated with this new product, Kemgard HPSS, from Sherwin-Williams.

Please contact Sherwin-Williams if you are looking for new product technology for your PVC applications. We have the answer: Kemgard HPSS.

Sherwin-Williams Chemicals
www.kemgard.com

Technical Service
601 Canal Road
Cleveland, OH 44113
Phone 216-566-2944
Fax 216-566-3837

Customer Service
PO Box 1028
Coffeyville, KS 67337
Phone 620-251-0072
Fax 620-251-7276

James Innes, S-W Technical Consultant
Flame Retardants Associates, Inc.
4 Saddlewood Court
Aurora, IL 60506
Phone 630-466-7811
Fax 630-466-7820
Email: jdinnes_fra@msn.com