

MINIFIBERS, INC.

**SHORT STUFF® in
Elastomeric Roof Coatings**



Purpose

The purpose of this technical bulletin is to demonstrate the relative performance of various grades of SHORT STUFF® High-Density Polyethylene (HDPE) in styrene acrylic and polyurethane elastomeric roof coatings (ERC).

Executive Summary

This technical bulletin confirms several distinct performance advantages of using SHORT STUFF® fibrillated HDPE in styrene acrylic and polyurethane roof coatings. The polyurethane ERC containing SHORT STUFF® absorb significantly less water, resulting in improvements of up to 75% in water vapor permeability. Elastomeric roof coatings containing SHORT STUFF® fibrillated HDPE will also require less thickener to reach the same viscosity as a standard formula.

The incorporation of SHORT STUFF® in elastomeric roof coatings (ERC) can provide a balance of tensile strength and elongation and create a textured finish (if desired). In large scale commercial applications where a fiber mat is traditionally used, the added texture and durability may allow the elimination of this step, therefore drastically reducing the time and cost involved.

Performance properties such as dirt pick up resistance, resistance to ponded water, and adhesion to concrete all pass the required ASTM D6083 standards. Selecting a larger grade of SHORT STUFF® can create texture, which is beneficial in high traffic pathways.

Summary of the Project

In this study we evaluated three different grades of SHORT STUFF® in both styrene acrylic and polyurethane elastomeric roof coatings. The different grades of SHORT STUFF® tested are described in **Table 1** below:

Table 1. Properties of SHORT STUFF®

	ESS5F	E380F	E780F
Length (mm)	~0.1	~0.5	~0.9
Diameter (mm)	5	15	25
Surface Area (m ² /gm)	12	8	8

The styrene acrylic ERC, all of which contained 15 pounds of ZnO, are described in **Table 2** and **Table 3**, and the polyurethane samples are described in **Table 4** below:

Table 2. 39% PVC; 51% VS ERC based on Encor® Flex 192 – SHORT STUFF® Grades & Dosages

	ERC-192-A1	ERC-192-B2	ERC-192-C3	ERC-192-D4
SHORT STUFF® Grade	---	ESS5F	E380F	E780F
Weight Percent SHORT STUFF®	0%	~0.5%	~0.5%	~0.5%

Table 3. 39% PVC; 51% VS ERC based on Encor® Flex 192 – SHORT STUFF® Grades & Dosages

	ERC-192-A1	ERC-192-B2	ERC-192-E5	ERC-192-D4	ERC-192-F6
SHORT STUFF® Grade	---	ESS5F	ESS5F	E780F	E780F
Weight Percent SHORT STUFF®	0%	~0.5%	~1.0%	~0.5%	~0.25%

Table 4. 39% PVC; 51% VS ERC based on Bayhydrol UH 2864 – SHORT STUFF® Grades & Dosages

	ERC-2864-1	ERC-2864-2	ERC-2864-3
SHORT STUFF® Grade	---	ESS5F	E780F
Weight Percent SHORT STUFF®	0%	~0.5%	~0.5%

Sample Preparation

Each styrene acrylic and polyurethane elastomeric roof coating sample was prepared individually. The styrene acrylic formulas are shown in **Table 5** and **Table 6**, and the polyurethane formulas are shown in **Table 7** and **Table 8** as follows.

Table 5. 39% PVC; 51% VS ERC Styrene Acrylic Control Formula

Elastomeric Roof Coating Based on Encor® Flex 192 Formulation # ERC-192-A1 Control			
Ingredients	Function	Weight (Lbs.)	Volume (US Gallons)
Grind			
Water	Solvent	166.9	20.00
Ipil BP 507	In-can biocide	2.0	0.22
DAPRO DF 696	Defoamer	3.0	0.41
Bermocoll Prime 3500	Cellulosic thickener	2.0	0.18
Ecodis NP	Dispersant, ZnO stability	7.0	0.64
KTPP	Dispersant, ZnO stability	1.0	0.10
RCL 595	Hiding	75.0	2.25
Minex 4	Durable extender	375.0	17.28
Zinc Oxide 800L	Mildewcide	15.0	0.33
Grind for 20 minutes, then add biocide slowly with good agitation:			
Letdown			
Ipel FAP 492	Film mildewcide	6.0	0.66
Encor® Flex 192	Elastomeric binder	469.8	54.00
DAPRO DF 696	Grind defoamer	2.0	0.27
Texanol	Coalescent	6.0	0.88
Ammonium Hydroxide-28%	Buffer	0.5	0.06
Premix next two items and add slowly with good agitation:			
Water	Solvent	18.9	2.26
Coapur XS-71	HEUR KU Builder	4.0	0.46
Mix at medium speed for 15 minutes			
Totals		1154.1	100.00
Paint Properties			
PVC %	38.7%		
Volume Solids %	51.4%		
Weight Solids %	64.7%		

Table 6. 39% PVC; 51% VS ERC Styrene Acrylic Formula w/ SHORT STUFF®

Elastomeric Roof Coating Based on Encor® Flex 192 Formula # ERC-192-B2 w/ SHORT STUFF®			
Ingredients	Function	Weight (Lbs.)	Volume (US Gallons)
Grind			
Water	Solvent	166.9	20.00
Ipel BP 507	In-can biocide	2.0	0.22
DAPRO DF 696	Defoamer	3.0	0.41
Bermocoll Prime 3500	Cellulosic thickener	2.0	0.18
Ecodis NP	Dispersant, ZnO stability	7.0	0.64
KTPP	Dispersant, ZnO stability	1.0	0.10
RCL 595	Hiding	75.0	2.25
Minex 4	Durable extender	361.5	16.66
Zinc Oxide 800L	Mildewcide	15.0	0.33
		633.4	40.79
Grind for 15 minutes, then add HDPE fibers slowly and grind 5 more minutes:			
SHORT STUFF® (Various)	Fibrillated HDPE Additive	5.0	0.62
Ipel FAP 492	Film mildewcide	6.0	0.66
Encor® Flex 192	Elastomeric binder	469.8	54.00
DAPRO DF 696	Grind defoamer	2.0	0.27
Texanol	Coalescent	6.0	0.88
Ammonium Hydroxide-28%	Buffer	0.5	0.06
Premix next two items and add slowly with good agitation:			
Water	Solvent	18.9	2.26
Coapur XS-71	HEUR KU Builder	4.0	0.46
Mix at medium speed for 15 minutes			
Totals		1145.6	100.00
Paint Properties			
PVC %	38.7%		
Volume Solids %	51.4%		
Weight Solids %	64.4%		

Table 7. 39% PVC; 51% VS ERC Polyurethane Control Formula



Elastomeric Roof Coating Based on Bayhydrol UH 2864 Formulation # ERC-2864-1			
Ingredients	Function	Weight (Lbs.)	Volume (us Gallons)
Grind			
Water	Solvent	141.9	17.00
Ipel BP 507	In-can biocide	2.0	0.22
DAPRO DF 696	Defoamer	3.0	0.41
Bermocoll Prime 3500	Cellulosic thickener	1.0	0.09
Coadis 123K	Dispersant	14.0	1.55
Tiona 596	Hiding	75.0	2.25
Omyacarb 10	Extender	400.0	17.75
		636.9	39.27
Grind for 20 minutes, then add biocide slowly with good agitation:			
Ipel FAP 492	Film mildewcide	6.0	0.66
Letdown			
BAYHYDROL UH 2864	Polyurethane dispersion	517.6	56.38
DAPRO DF 696	Defoamer	2.0	0.27
Texanol	Coalescent	6.0	0.76
Ammonium Hydroxide 28%	Buffer	2.0	0.24
Add next two items slowly with good agitation:			
Water	Solvent	15.9	1.90
Coapur XS 71	HEUR KU Builder	4.5	0.52
Mix at medium speed for 15 minutes			
		Totals	1190.9
			100.00
Paint Properties			
PVC %			39.2%
Volume Solids %			51.0%
Weight Solids %			65.5%



Table 8. 39% PVC; 51% VS ERC Polyurethane Formula w/ SHORT STUFF®



Elastomeric Roof Coating Formulation # ERC-2864-2			
Ingredients	Function	Weight (Lbs.)	Volume (US Gallons)
Grind			
Water	Solvent	141.9	17.00
Ipel BP 507	In-can biocide	2.0	0.22
DAPRO DF 696	Defoamer	3.0	0.41
Bermocoll Prime 3500	Cellulosic thickener	1.0	0.09
Coadis 123K	Dispersant	14.0	1.55
Tiona 596	Hiding	75.0	2.25
Omyacarb 10	Extender	386.0	17.13
		622.9	38.65
Grind for 15 minutes, then add HDPE fibers slowly and grind 5 more minutes:			
SHORT STUFF (Various)	Fibrillated HDPE Additive	5.0	0.62
Grind for 20 minutes, then add biocide slowly with good agitation:			
Ipel FAP 492	Film mildewcide	6.0	0.66
Letdown			
BAYHYDROL UH 2864	Polyurethane dispersion	517.6	56.38
DAPRO DF 696	Defoamer	2.0	0.27
Texanol	Coalescent	6.0	0.76
Add next two items slowly with good agitation:			
Water	Solvent	19.3	2.31
Coapur XS 71	HEUR KU Builder	3.0	0.35
Mix at medium speed for 15 minutes			
		Totals	1181.8
			100.00
Paint Properties			
PVC %			39.2%
Volume Solids %			51.0%
Weight Solids			64.8%



Key Observations

The following photos show the effect of SHORT STUFF® product grade selection on film smoothness and appearance. In general, the largest grade E780F imparts a more textured appearance, whereas 2.5 Lbs. (~0.25% percent by weight) of E780F has approximately the same appearance as 5 Lbs. (~0.5%) of the medium size grade E380F. It should also be noted that even at 10 Lbs. (~1.0%) of the smallest grade ESS5F, the ERC film remains smooth in appearance.


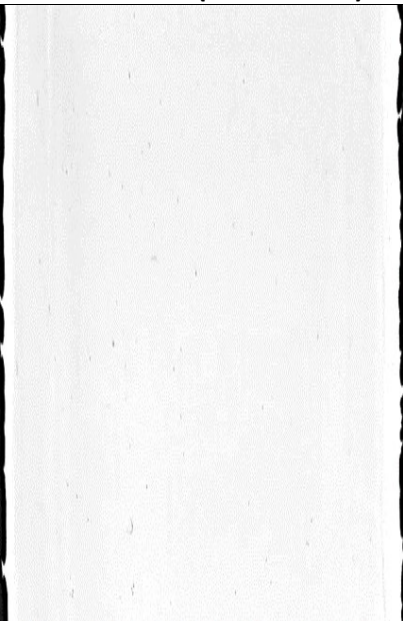

ERC-192-A1	ERC-192-B2
39 PVC 192 No Fibers	39 PVC 192 ~0.5% ESS5F
	

ERC-192-C3	ERC-192-D4
<p>39 PVC 192 ~0.5% E380F</p>	<p>39 PVC 192 ~0.5% E780F</p>
	

ERC-192-D4	ERC-192-F6
<p>39 PVC 192 ~0.5% E380F</p>	<p>39 PVC 192 ~0.25% E780F</p>
	

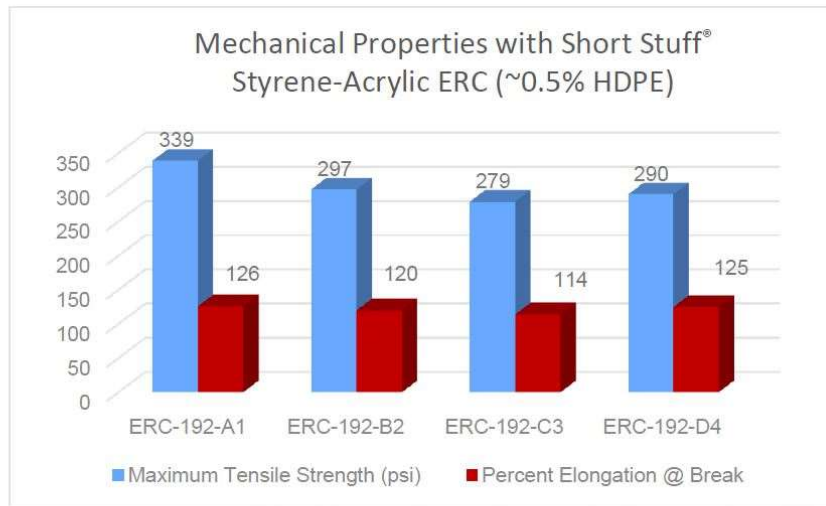
ERC-192-B2		RC-192-E5	
39 PVC	192	39 PVC	192
~0.5% ESS5F		~1.0% ESS5F	
			

As evident in the photos below, the polyurethane ERC containing ~0.5% (5 Lbs.) of ESS5F showed a smooth appearance, while the film with ~0.5% E780F showed a heavily textured appearance. This is due to the difference in product size.

ERC-2864-1 (NO HDPE)	ERC-2864-2 (0.5% ESS5F)	ERC-2864-3 (0.5% E780F)
39 PVC UH 2864 PUD		
		

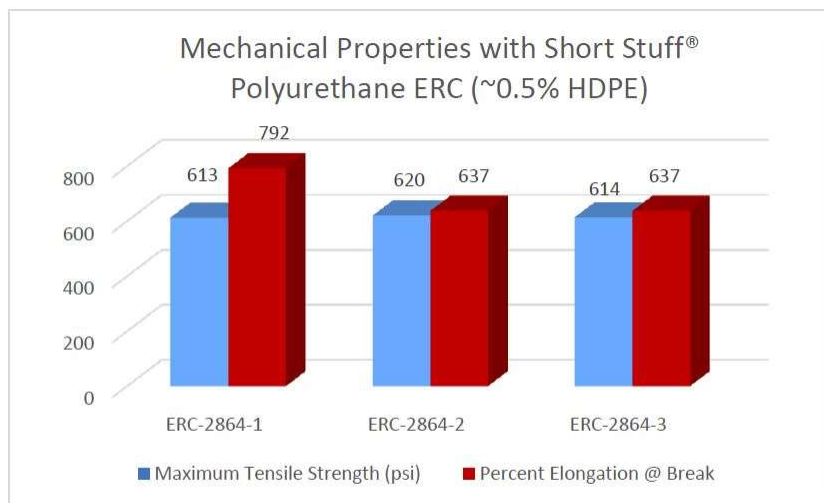
All styrene acrylic ERC meet the ASTM 6083 standards for tensile strength (>200 psi) and elongation (>100%). All polyurethane ERC offer outstanding mechanical properties. As shown in **Figure 5** and **Figure 6** below, incorporating Short Stuff® fibrillated HDPE into the styrene acrylic ERC results in slightly lower tensile strength, while incorporating Short Stuff® into the polyurethane ERC moderately lowers elongation.

Figure 5: Tensile Strength and Elongation for Styrene Acrylic ERC



	ERC-192-A1	ERC-192-B2	ERC-192-C3	ERC-192-D4
Short Stuff® Grade	---	ESS5F	E380F	E780F
Weight Percent Short Stuff®	0%	~0.5%	~0.5%	~0.5%

Figure 6: Tensile Strength and Elongation for Polyurethane ERC



	ERC-2864-1	ERC-2864-2	ERC-2864-3
Short Stuff® Grade	---	ESS5F	E780F
Weight Percent Short Stuff®	0%	~0.5%	~0.5%

All styrene acrylic roof coatings showed very good to excellent resistance to dirt pick-up, while all polyurethane systems displayed the traditional poor dirt pick-up resistance properties associated with polyurethane.

Figure 7: Dirt Pick-up Resistance of Styrene Acrylic ERC

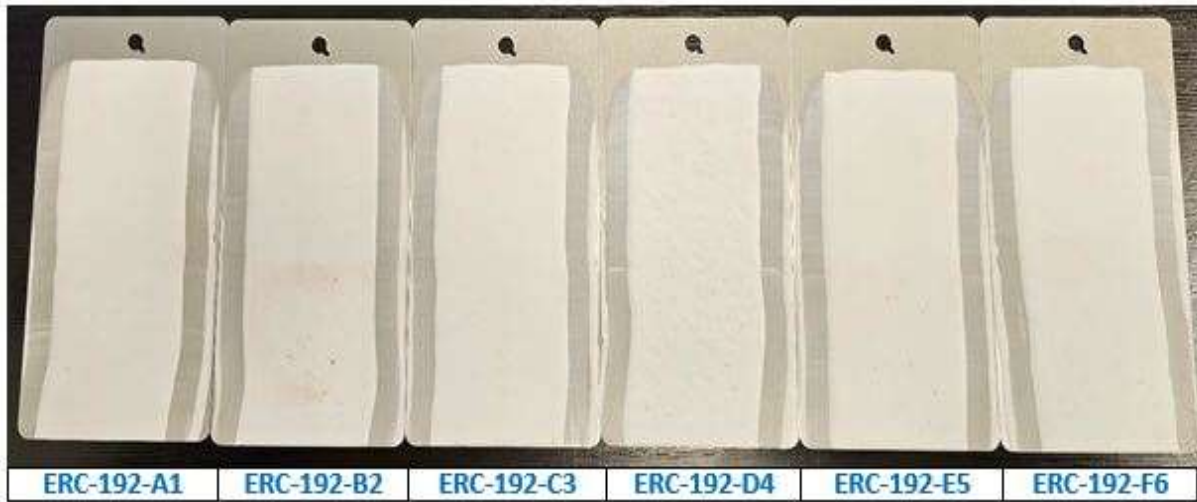


Figure 8: Dirt Pick-up Resistance of Polyurethane ERC



The incorporation of SHORT STUFF® fibrillated HDPE in polyurethane systems significantly improved the resistance to water vapor permeability, and water absorption by up to 75%, as seen in **Figure 9** and **Figure 10**. All polyurethane and styrene acrylic ERC systems passed the ASTM D6083 standard.

Figure 9: Perms of Polyurethane ERC

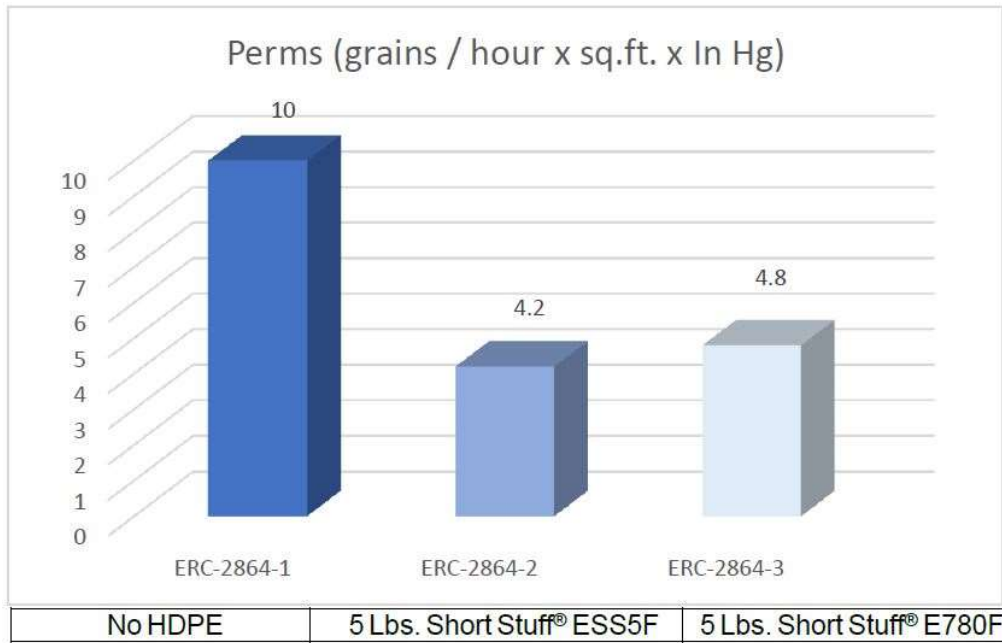
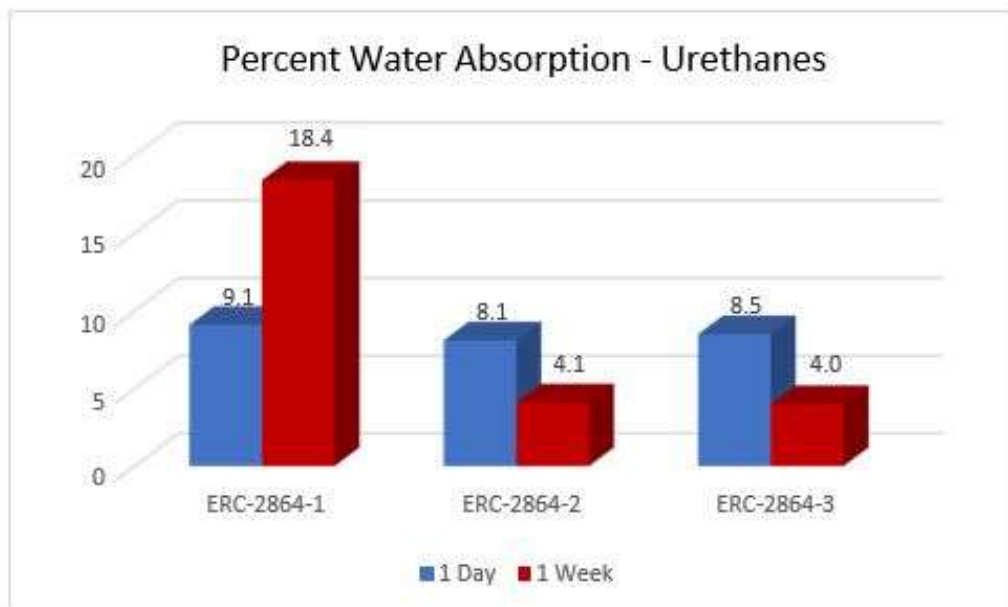
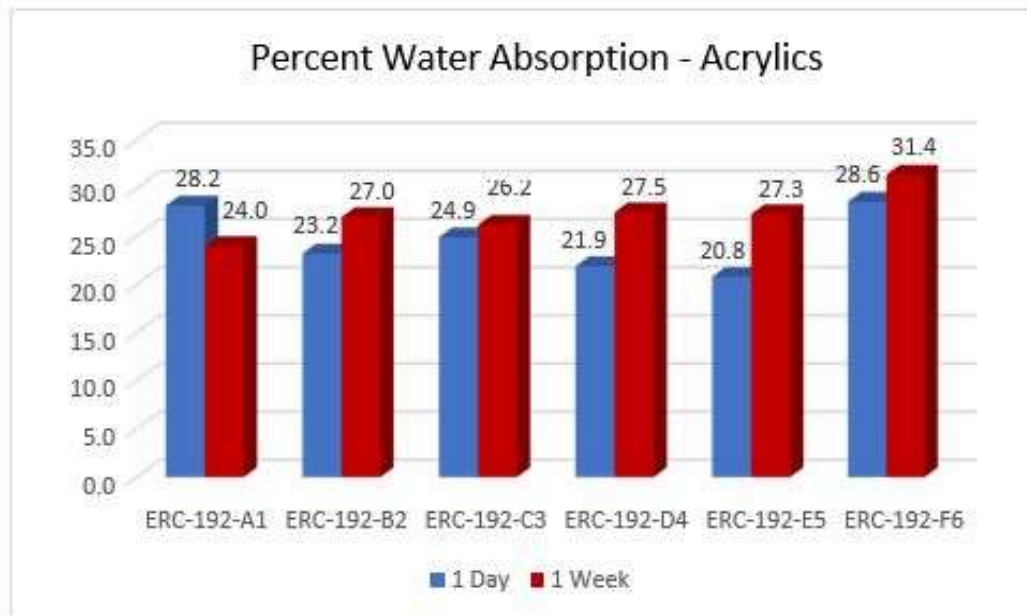


Figure 10: Polyurethane Water Absorption



After one week under water, the polyurethane films containing Short Stuff® showed significantly less water absorption, as can be observed in **Figure 10**. For the styrene acrylic ERC, incorporating Short Stuff® had a relatively minor impact on water absorption, as shown in **Figure 11**.

Figure 11: Styrene Acrylic Water Absorption



- All styrene acrylic and polyurethane ERC with SHORT STUFF® fibrillated HDPE had excellent resistance to ponding water resistance. All coatings passed 6 weeks of resistance to ponded water.
- The Incorporation of SHORT STUFF® can help to reduce the total thickener amount required to reach target viscosity in roof coatings.
- All formulas containing SHORT STUFF® had excellent heat aged coating stability and adhesion to concrete.

Conclusions

In polyurethane systems, the coatings containing SHORT STUFF® displayed significant improvements in vapor permeability resistance and water absorption of up to 75%. In both systems, performance properties such as dirt pick up resistance, resistance to ponded water, and adhesion to concrete all pass the required ASTM D6083 standards. Selecting a larger grade of SHORT STUFF® can create texture, which is beneficial in high traffic pathways, and may allow for the elimination of the base scrim process.

ACKNOWLEDGEMENT

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