



## Pilot Fabric Development Opportunity with AFFOA and Z-Polymers

### *Call for U.S. Textile Mill Participation in Pilot-Scale Fabrication of Reinforcement Material for Electrolyzer Membranes*

#### Overview

Advanced Functional Fabrics of America, Inc. (AFFOA), in partnership with Z-Polymers, is seeking U.S.-based textile manufacturing partners to participate in a pilot-scale production trial of a novel reinforcement fabric designed for electrolyzer membranes used in fuel cells. In addition to this primary application, Z-Polymers is actively exploring additional opportunities in screen printing and filtration using similar fabric constructions. Furthermore, ongoing yarn development efforts are expected to expand the application space of Tullomer™-based textiles, enabling new market opportunities across a variety of high-performance sectors.

This initiative builds upon a successful lab-scale development effort completed in 2023–2024 by the AFFOA technical team under the Product Accelerator for Functional Fabrics (PAFF 1.0) program.

Z-Polymers' proprietary Tullomer™ fiber was developed over the course of AFFOA's PAFF 1.0 initiative. During that period, AFFOA collaborated with Z-Polymers to convert its proprietary composite yarn into scrim fabric using automated equipment, including the CCI Studio Dobby Loom. AFFOA also produced sample fabrics that enabled Z-Polymers to provide prospective customers with early prototypes for evaluation. Approximately 15M of fabric was woven. Various samples were prepared for customer evaluation, some examples of these at three different pick counts (Weft 70, 75, 80 ppi/Warp 70 epi) are shown in the appendix of this document.

The current effort is supported under PAFF 2.0, where Z-Polymers has been selected to further scale and commercialize this innovative solution. AFFOA will support Z-Polymers in identifying and engaging suitable textile mills across the U.S. to carry out pilot-scale production and validation of the fabric.

#### Why Partner on This Pilot?

- **Advanced Material Advantage:** The fabric leverages *Tullomer*™, a proprietary PFAS-free liquid crystal polymer (LCP) developed by Z-Polymers, offering unmatched thermal, chemical, and environmental performance. It presents a sustainable alternative to conventional materials such as expanded PTFE (ePTFE).
- **Target Application:** The fabric will serve as a **reinforcement layer for electrolyzer membranes**, addressing critical performance and sustainability

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challenges in fuel cell systems. The fabric also performs in products used for filtration, screen-printing, and electronics.

- Growing Market Demand:** Z-Polymers is experiencing early interest from prospective customers in the clean energy sector who are seeking high-performance, environmentally responsible material solutions. This growing demand underscores the market potential for Tullomer™-based scrim fabrics in applications such as energy storage and fuel cells.

Below are the projections provided to Z-Polymers by its launch customer for this specific market. The volume of 2M m<sup>2</sup> represents about 10% market share, while customer’s actual market share is 35 – 40% in the segment (conservative estimates for valuation purposes). The product roadmaps for the tullomer and multifilament fibers are located in the appendix of this document.

<i>Projections</i>	<b>Year 1</b>	<b>Year 2</b>	<b>Year 3</b>	<b>Year 4</b>	<b>Year 5</b>	<b>Year 6</b>
<i>Electrolyzer (m<sup>2</sup>)</i>	56,954	150,764	470,716	1,204,350	1,543,058	1,982,052
<i>Screen Printing (m<sup>2</sup>)</i>	5,000	50,000	150,000	400,000	750,000	1,000,000
<i>Filtration (m<sup>2</sup>)</i>	10,000	25,000	100,000	500,000	1,000,000	2,000,000

- Technology Enablement:** By participating in this initiative, textile mills have the opportunity to work with cutting-edge functional materials and play a leading role in next-generation fabric applications. This collaboration opens the door to strategic partnerships with Z-Polymers and AFFOA, and positions participants at the forefront of innovation in clean energy and advanced composites.
- Future Markets:** Z-polymers is currently developing multifilament yarn that will be used for woven scrim fabrics. Textile mills who collaborate on this pilot program also have the additional potential opportunity to directly work with Z-Polymers on this multifilament construction.

- Fabric Conversion Specifications**

The fabric conversion specifications are created by AFFOA Lead Textile Technologist Gabrielle Ferreira, based on the lab trial conducted at AFFOA through the PAFF 1.0 project. That document, the tullomer scrim fabric data sheet and images of the previously woven fabric can be found in the appendix of this document.



## About Z-Polymers

Z-Polymers is a materials science company focused on advanced polymer innovation. Its proprietary *Tullomer*<sup>™</sup> platform is a PFAS-free liquid crystal polymer exhibiting:

- Exceptional strength-to-weight ratio
- Outstanding chemical resistance and thermal stability
- Low outgassing and low toxicity
- Low flammability (chars, no drip)
- Ultra-low carbon footprint

*Tullomer*<sup>™</sup> is currently available in multiple formats, including multifilament yarns suitable for woven, and nonwoven fabric production.

Learn more: <https://z-polymers.com>

## About Advanced Functional Fabrics of America, Inc. (AFFOA)

AFFOA is a non-profit, public-private partnership and one of the Manufacturing USA Innovation Institutes headquartered in Cambridge, MA. AFFOA's mission is to "Rekindle the domestic textiles industry by leading a nationwide enterprise for advanced fiber & fabric technology development and manufacturing, enabling revolutionary system capabilities for national security and commercial markets". <https://affoa.org/>

## About Product Accelerator for Functional Fabrics (PAFF) Program

Launched in 2024, the PAFF program enables selected companies to leverage AFFOA's technical engineering team with expertise in advanced textiles across design, prototyping, integration, testing, and process engineering at no direct cost to fill critical gaps in their functional fabric development processes and ultimately reduce time to market. <https://affoa.org/opportunity/paff-2-0-product-accelerator-for-functional-fabrics/>

## How to Participate

If you are interested in participating in this opportunity and learning more about the details, please contact the AFFOA team for the next step

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To be considered for future AFFOA collaboration projects, please complete the following:

**[\[Vendor Survey Form – Z-Polymers Pilot Trial\]](#)**

This form collects essential information on your mill's capabilities, production equipment, material handling experience (especially with high-performance yarns), and availability to support future trials.

**Deadline to Submit:** June 15<sup>th</sup>, 2025



# Appendix



## 90 Denier Tullomer Yarn - Fabric Conversion Specifications

### Warping

Yarn Denier	90d (grams/9000m)
Warp End Count	70 ends per inch (epi)
Warp Tension	7 grams/end (0.08 g/d)
Warp Width	60 inches
Warp Ends	4,200 ends

### Weaving

Construction	Plain, Balanced, Square Weave
Warp and Fill Count	70 ends per inch (epi) warp, 70 picks per inch (ppi) weft
Loom	Rapier*
Harness	10 total, 8 for plain weave, 2 for leno weave*
Reed	35 dent reed, 2 ends per dent*
Selvage Construction	Leno Weave*
Static Control	Static Bars*
Pick Rate	80 pics per minute
Target Fabric Width	58 - 60 inches
Target Fabric Weight	90 to 110 gsm
Put-up	3" core

### Scouring

Size Removal	PVA (PVOH)
Process	Circulating water at 80C with 0.05% surfactant
Tension Control	Required in both warp and weft direction to maintain warp and weft end spacing. Pin or clamp tenter frame recommended.
Drying	80 – 100°C, 0.5 to 2 minutes
Scoured Width	58 – 60 inches
Scoured weight	16 – 22 gsm
Put-up	3" core

### Calendaring

Temperature	140°C
Pressure	0.14 MPa, 20 psi
Roll Type	Polished chrome rolls
Speed	10 m/min
Finished Width	58 – 60 inches
Finished Weight	16 – 22 gsm
Finished Thickness	60 - 70 micrometers, 0.002 - 0.003 inches
Put-up	3" core

\*: Recommended but not required



# Z-Polymers



**Figure 1: Mounted customer fabric samples at 70, 75, and 80 epi**