

JEC

The Carbon Fiber Market in an Unstable Petrochemical Era

Unpredictable Winds, Resilient Materials: Navigating the New Normal

SPEAKER

Formosa Plastics Corp.

The Carbon Fiber Paradox

Historic downstream demand collision with unprecedented upstream supply instability.

Downstream Demand Pull

Unprecedented appetite for advanced structural materials:

- ✓ **Wind Energy Surge:** Trend towards massive, lightweight turbine blades.
- ✓ **Hydrogen Economy:** Growing demand for high-pressure storage vessels.
- ✓ **Aerospace Recovery:** Strong structural rebound in commercial and defense aviation.

Upstream Supply Shocks

Compounding vulnerabilities from traditional petrochem:

- ➔ **Geopolitical Friction:** Severe disruption to primary global shipping and supply channels.
- ➔ **Energy Cost Inflation:** Surging utility overhead directly impacting raw material output.
- ➔ **High Volatility:** Fast-paced commodity price fluctuations becoming the new standard.

The Precursor Vulnerability

How upstream petrochemical shocks immediately translate to downstream cost pressures.

100% Fossil Fuel Dependency

The production of high-performance polyacrylonitrile (PAN) precursor is chemically locked into upstream fossil refining.

- ✓ Directly bound to crude oil, propylene, and acrylonitrile (AN) supply lines.
- ✓ Fluctuations in crude oil prices trigger direct volatility in baseline raw material costs.
- ✓ No immediate high-volume synthetic alternatives exist on an industrial scale today.

The Energy Cost Double-Squeeze

The physical conversion of precursor into raw carbon fiber is highly thermal and energy-intensive.

- ➔ Requires continuous, ultra-high-temperature carbonization processes.
- ➔ Soaring industrial energy costs hit carbonization facilities directly.
- ➔ Creates a severe margin squeeze between volatile raw material costs and fixed pricing.

The Bifurcation of Carbon Fiber

Extreme capacity polarization is separating commodity grades from high-value applications.

Commodity Price Battlefield

Standard Modulus / Industrial Grade

Massive capacity expansions—specifically from regional Chinese suppliers—have flooded the standard commercial market.

- ✓ **Price Bloodbath:** Extreme margin erosion in low-barrier sectors (e.g. sporting goods).
- ✓ Overcapacity triggers a destructive race to the bottom on price.

High-Value Moats

Intermediate & High Modulus Grade

Critical engineering sectors command premium values, secured by rigorous validation and strict entry barriers.

- ➔ **Extreme Certification Moat:** Decades of testing in aerospace and space.
- ➔ **Inelastic Premium:** Exceptional margin resilience despite petrochemical instability.

Strategic Supply Chain Resilience

Unlocking competitive advantages by controlling the source and securing downstream trust.



Backward Integration

Securing absolute cost control and raw material supply stability by producing PAN precursor internally or via tight upstream ties.



Strategic Offtakes

Moving away from highly volatile spot markets toward long-term, predictable volume and capacity commitments with Tier-1 Wind OEMs.



Tech Alliances

Building joint development pipelines with hydrogen and defense manufacturers to secure long-term product lock-in.

Decoupling from Fossil Dependencies

Transforming petrochemical instability into the ultimate catalyst for green composite innovation.

The Next Generation Material Pathway

Two critical execution pillars for structural decoupling:

- ➔ **Green Precursor R&D:** Accelerating the development of bio-based materials (bio-AN, lignin) to bypass oil completely.
- ➔ **Circular Loop Economies:** Expanding the commercial viability of recycled Carbon Fiber (rCF) in secondary structures.
- ➔ **Low-Emission Manufacturing:** Deploying energy-efficient carbonization, utilizing micro-waves and clean, renewable grids.

"In an unstable petrochemical environment, resilience is not just about resisting the shock, it's more about controlling the quality and raw material."

FORMOSA PLASTICS CORP.