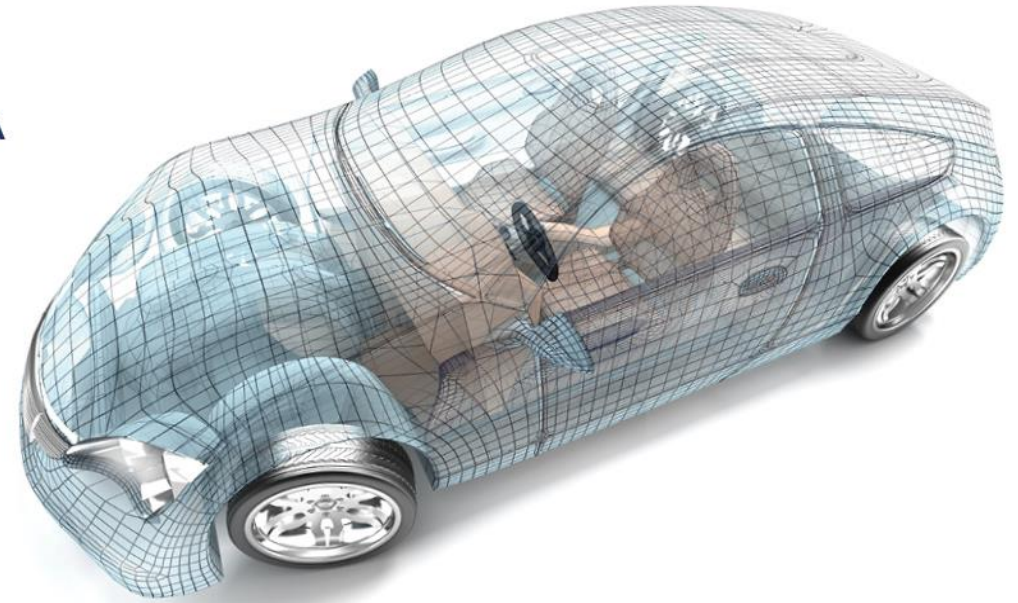




**THERMOPLASTIC  
COMPOSITES CONFERENCE**

**APRIL 29 - MAY 1, 2020 | SAN DIEGO, CA, USA  
HYATT REGENCY LA JOLLA AT AVENTINE**



# Design & Material Selection of Thermoplastic Composite Panels for Structural Components

Presented By: Darcy Hornberger  
Sr. Technology Manager  
PolyOne Advanced Composites

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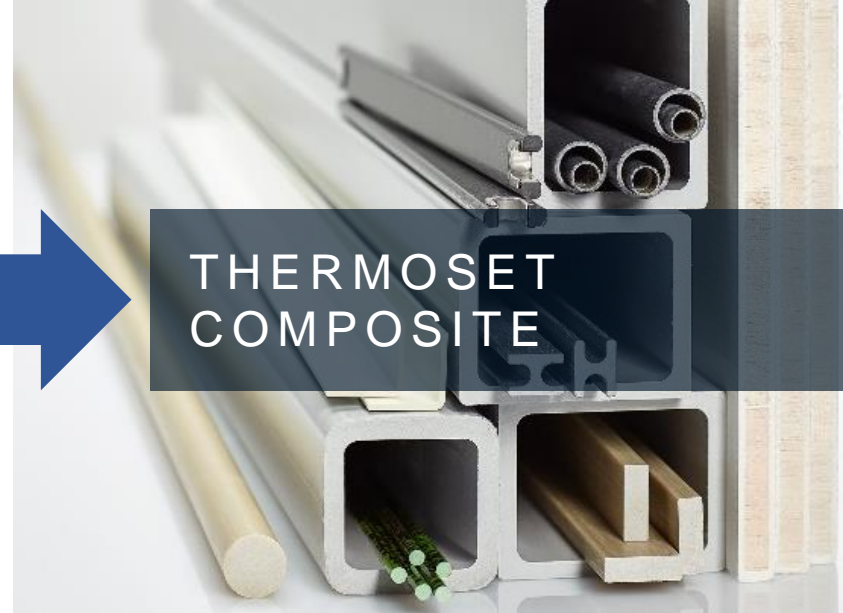
# DISCUSSION TOPICS

- WHAT IS A THERMOPLASTIC COMPOSITE
- THERMOPLASTIC COMPOSITES – OVERVIEW
- WHAT IS A SANDWICH PANEL?
- PANEL PERFORMANCE
- INSTALLATION METHODS
- APPLICATION EXAMPLES

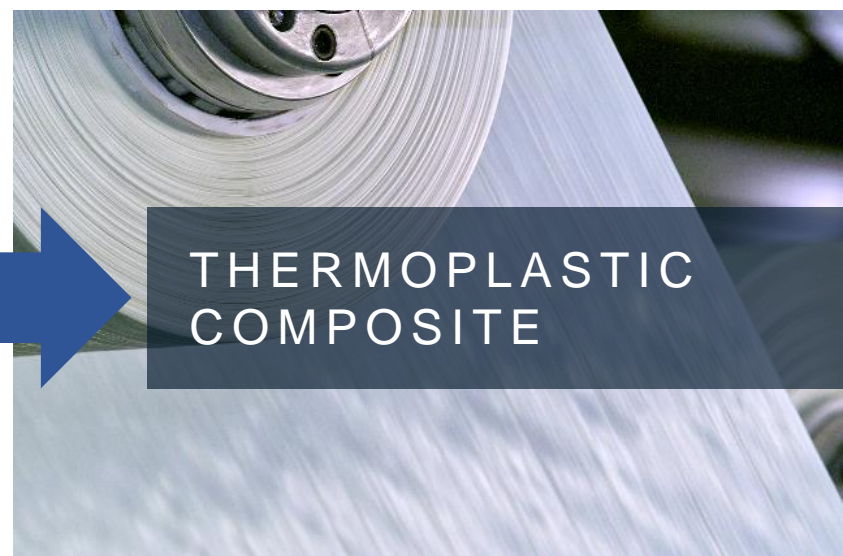
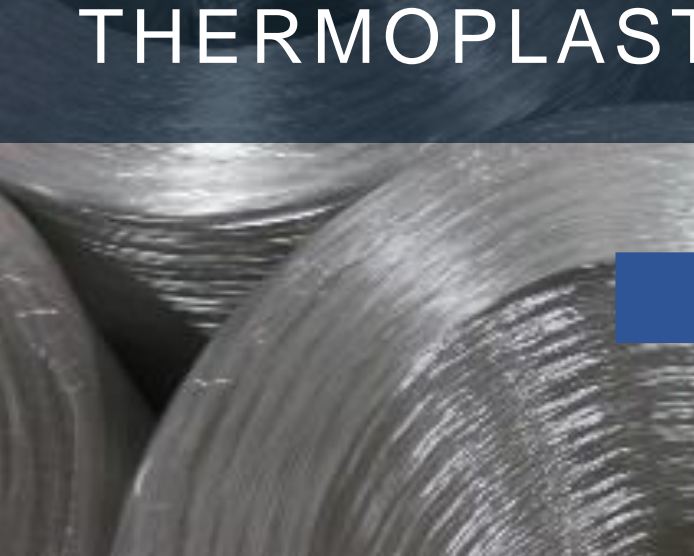




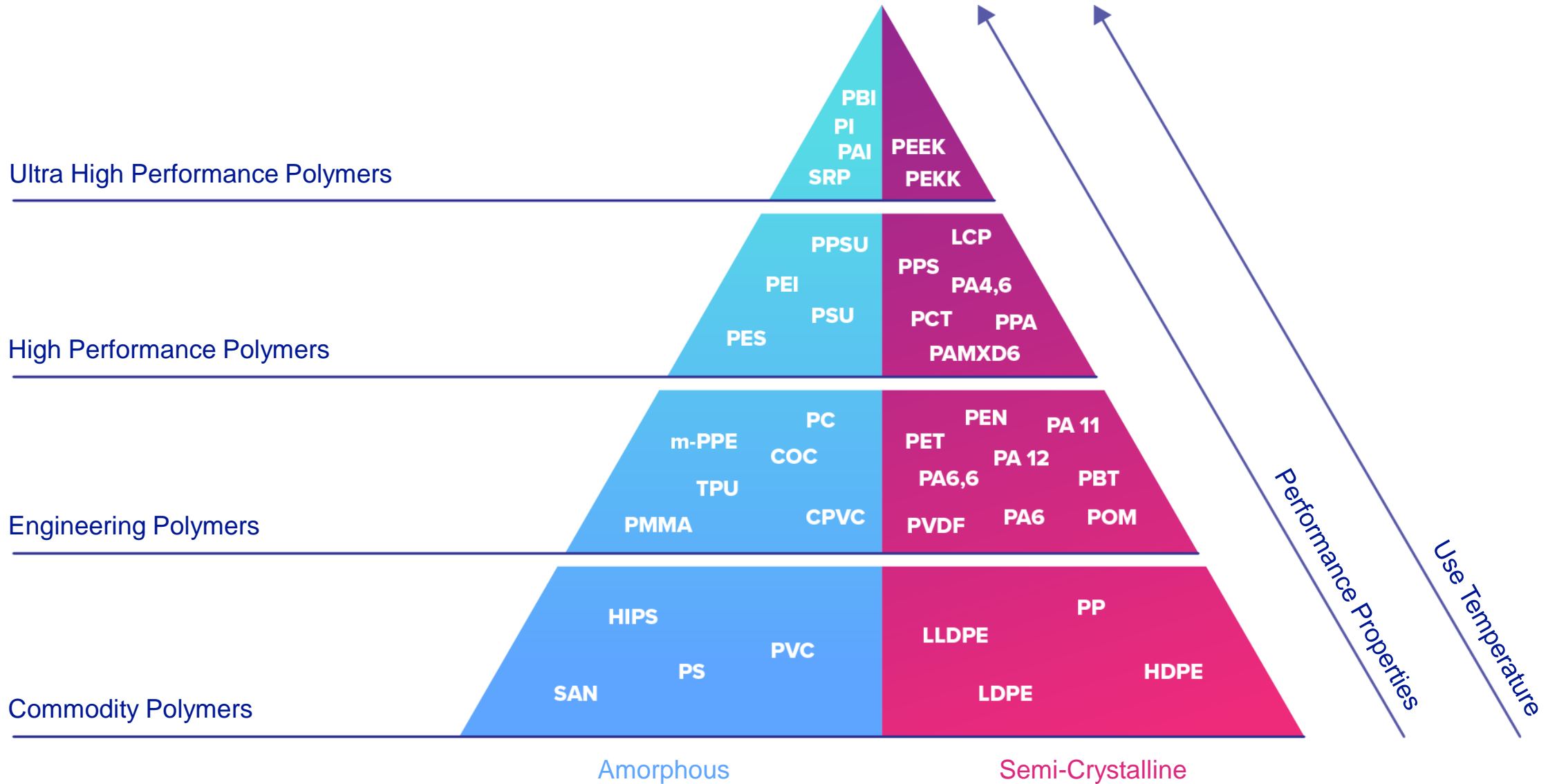
# THERMOSET VS. THERMOPLASTIC



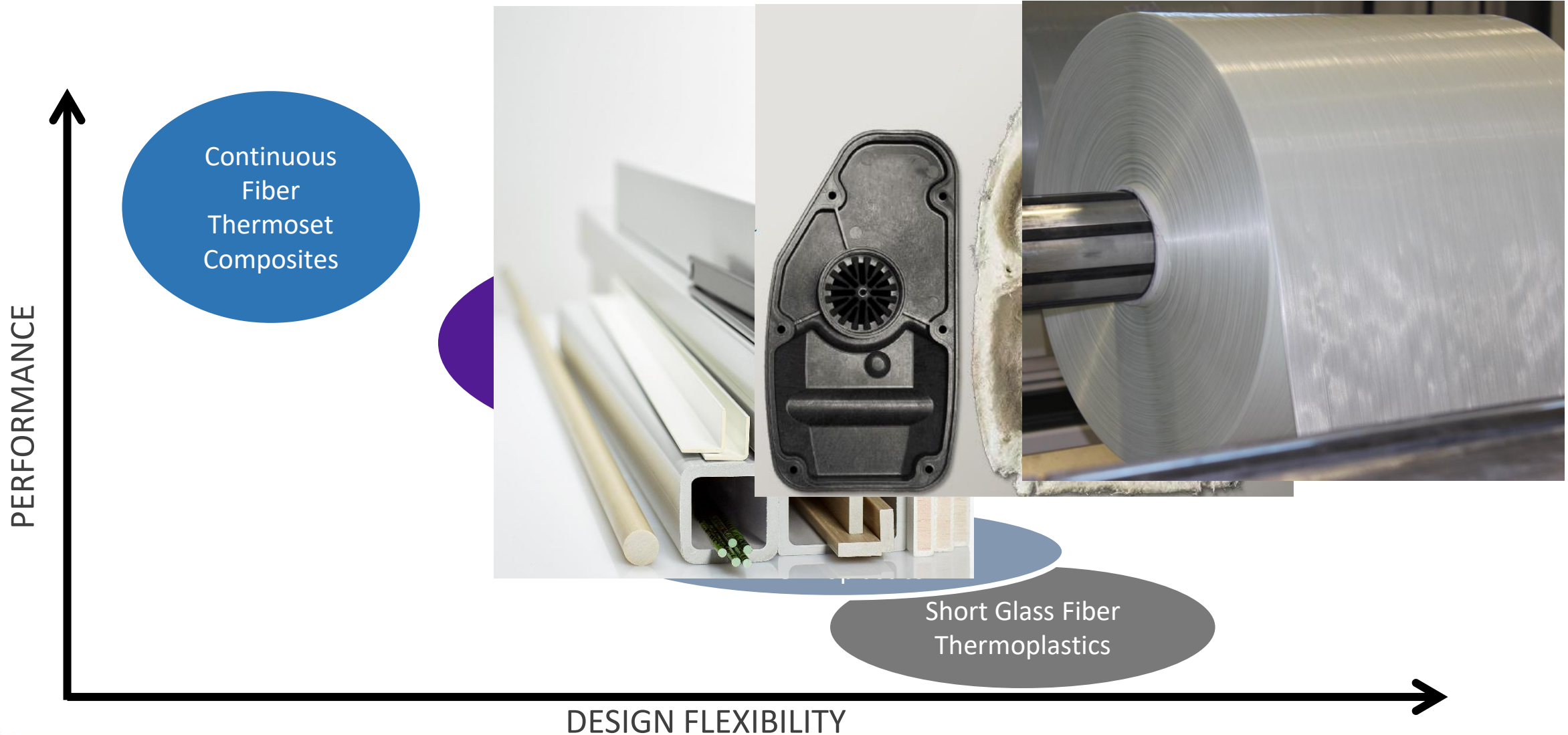
THERMOSET COMPOSITE



THERMOPLASTIC COMPOSITE



# THE VALUE OF THERMOPLASTIC COMPOSITES

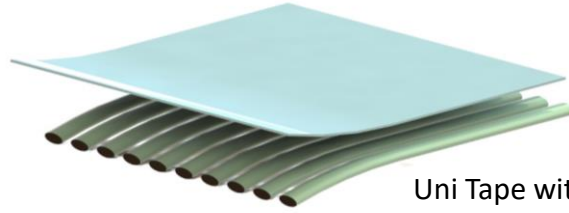




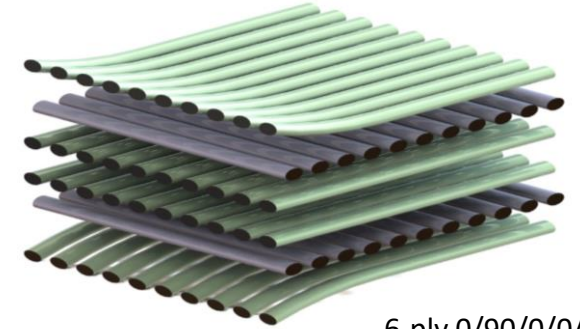
# LAMINATE CONFIGURATIONS



Unidirectional Tape



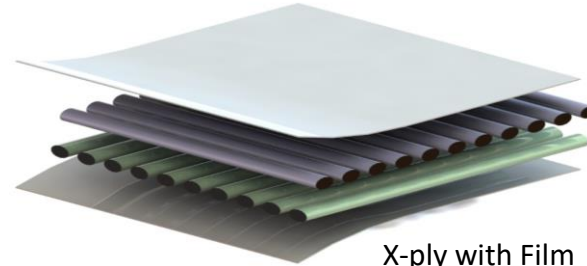
Uni Tape with Scrim



6-ply 0/90/0/0/90/0



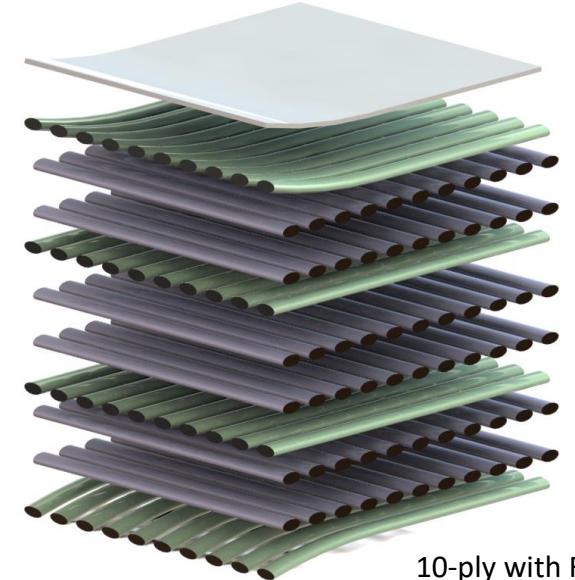
X-ply 0/90



X-ply with Film



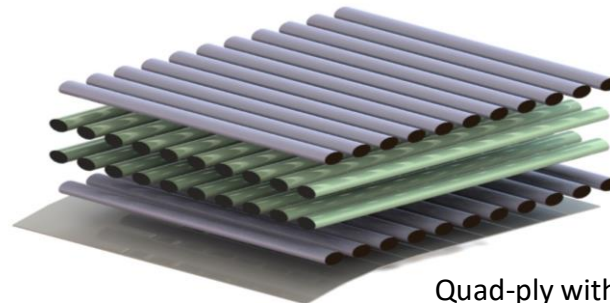
Tri-ply 0/90/0



10-ply with Film

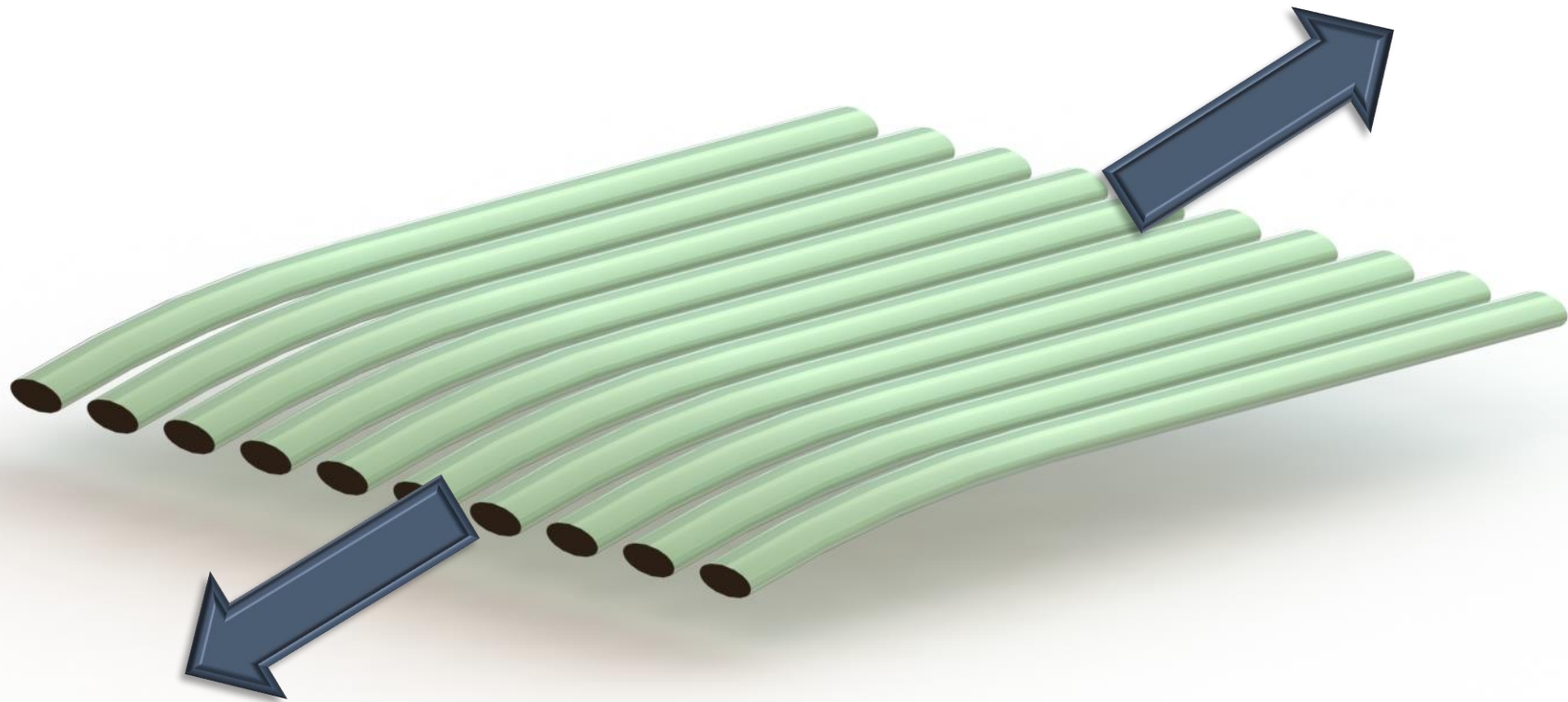


Quad-ply 0/90/90/0

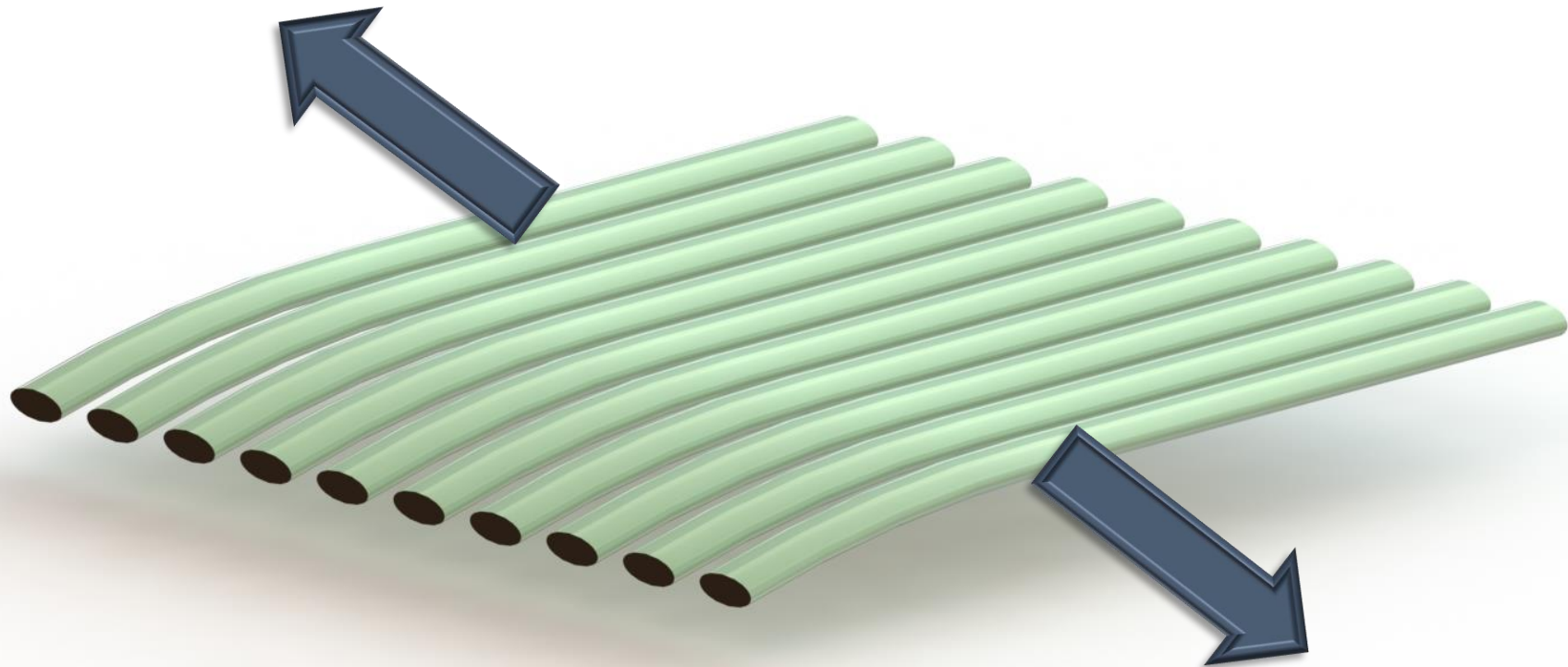


Quad-ply with Carrier Layer

# LAMINATE LOADING

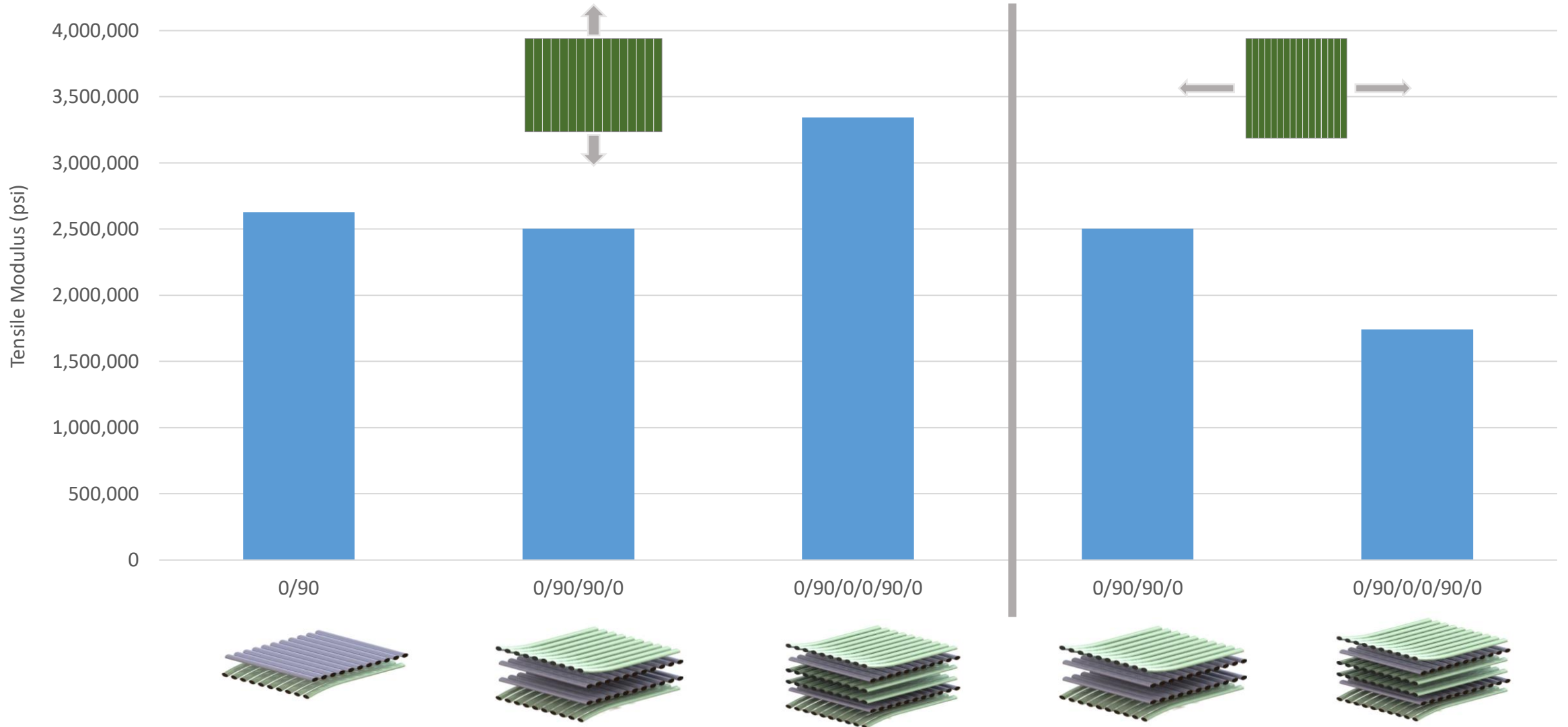


# LAMINATE LOADING

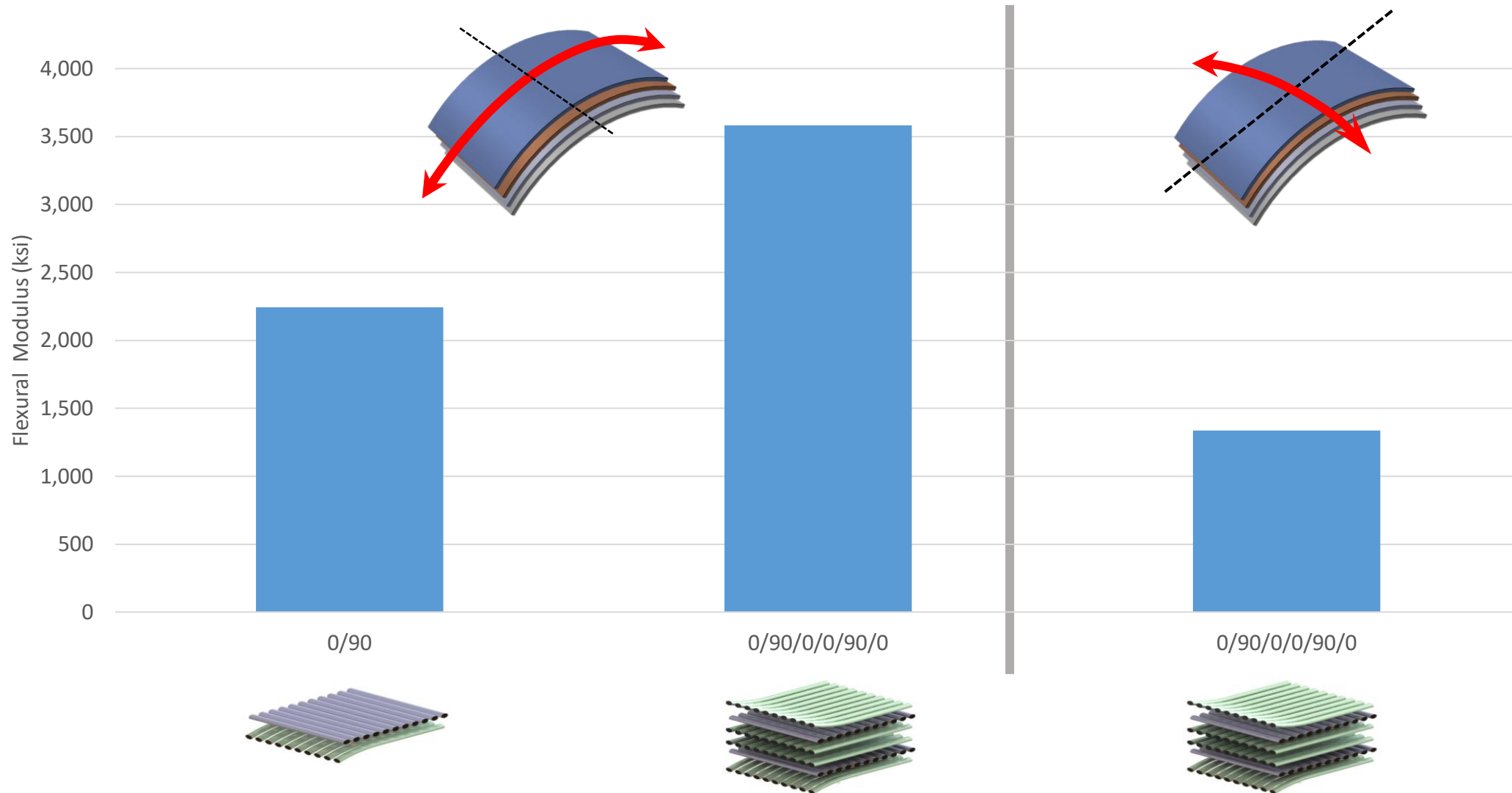




# IMPROVE PERFORMANCE THROUGH LAMINATE ARCHITECTURE

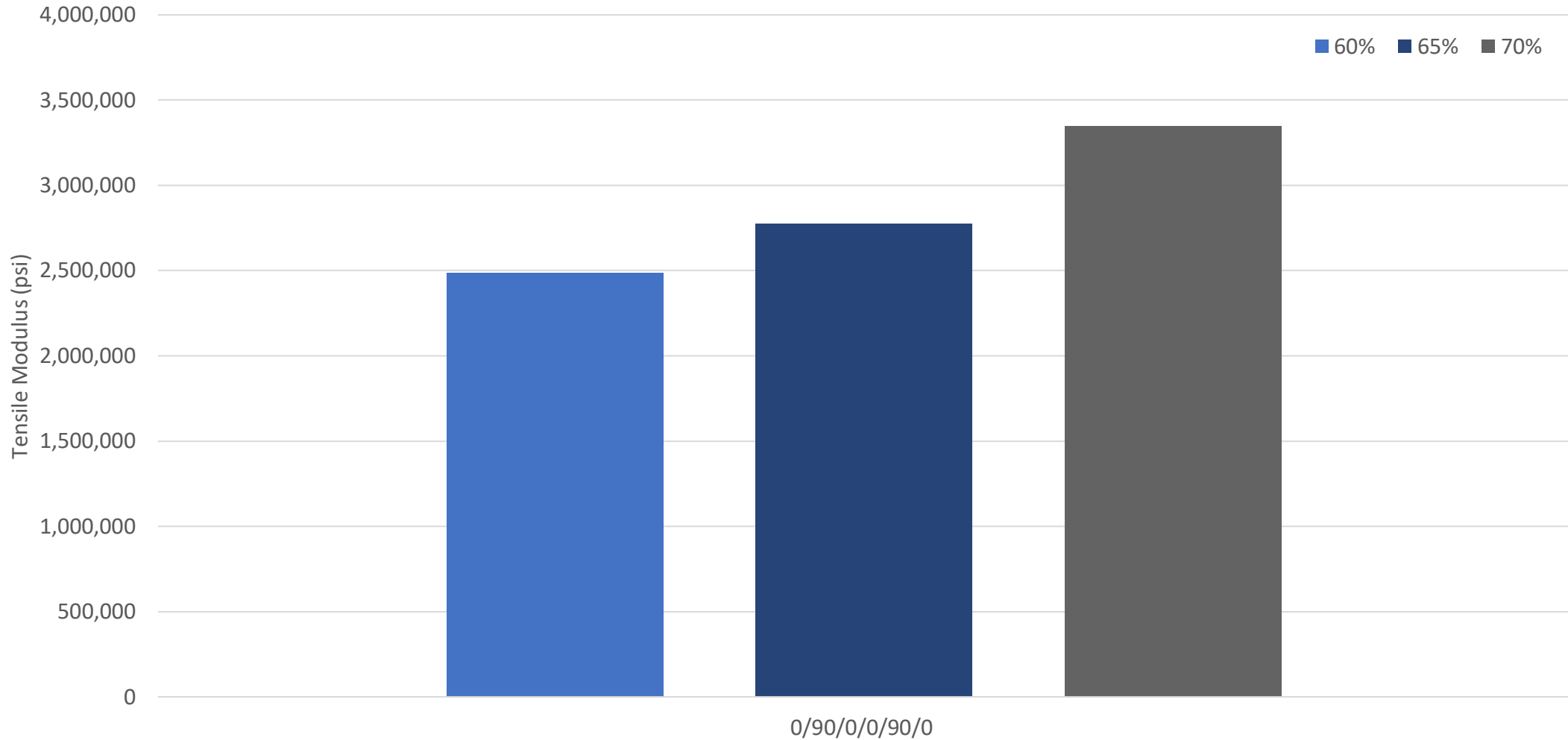


# LAYER PLACEMENT TO OPTIMIZE DESIGN





# FIBER VOLUME AFFECTS PERFORMANCE

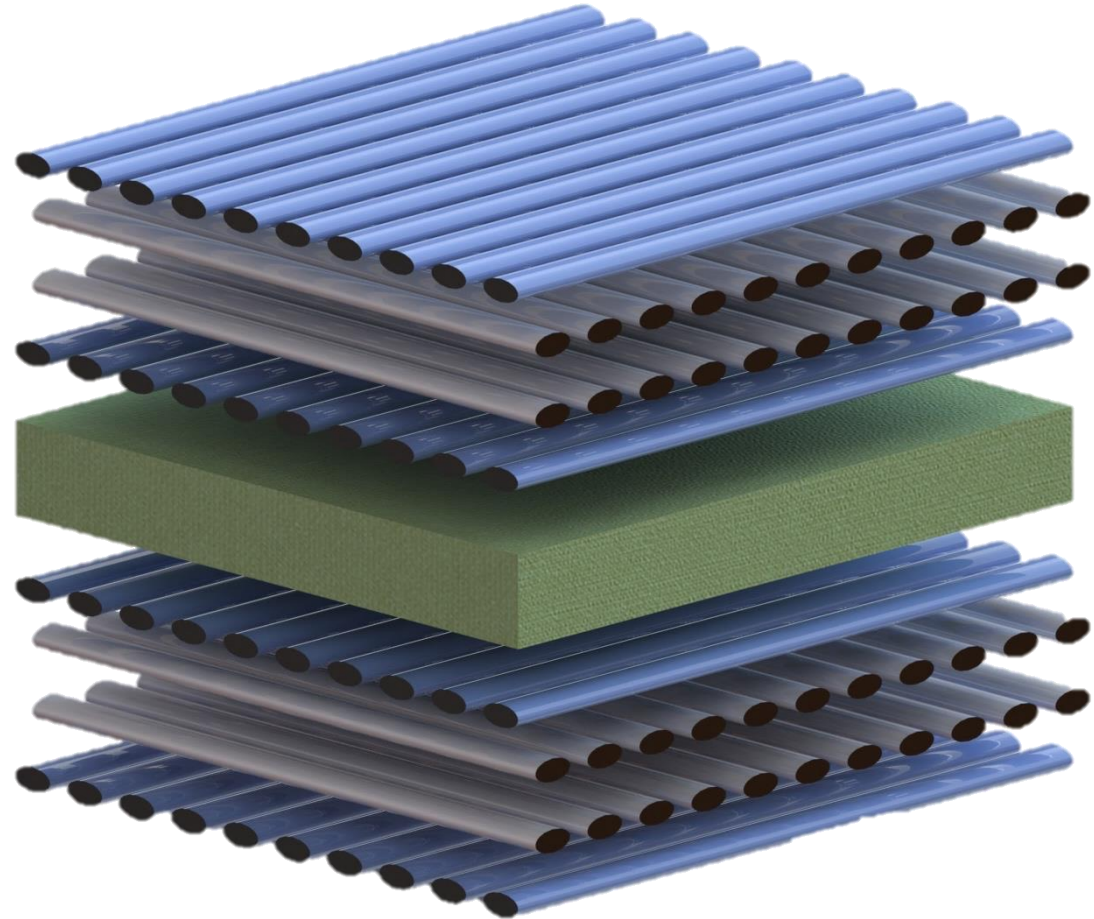


# WHAT IS A SANDWICH PANEL?

FIBER REINFORCED FACESHEETS

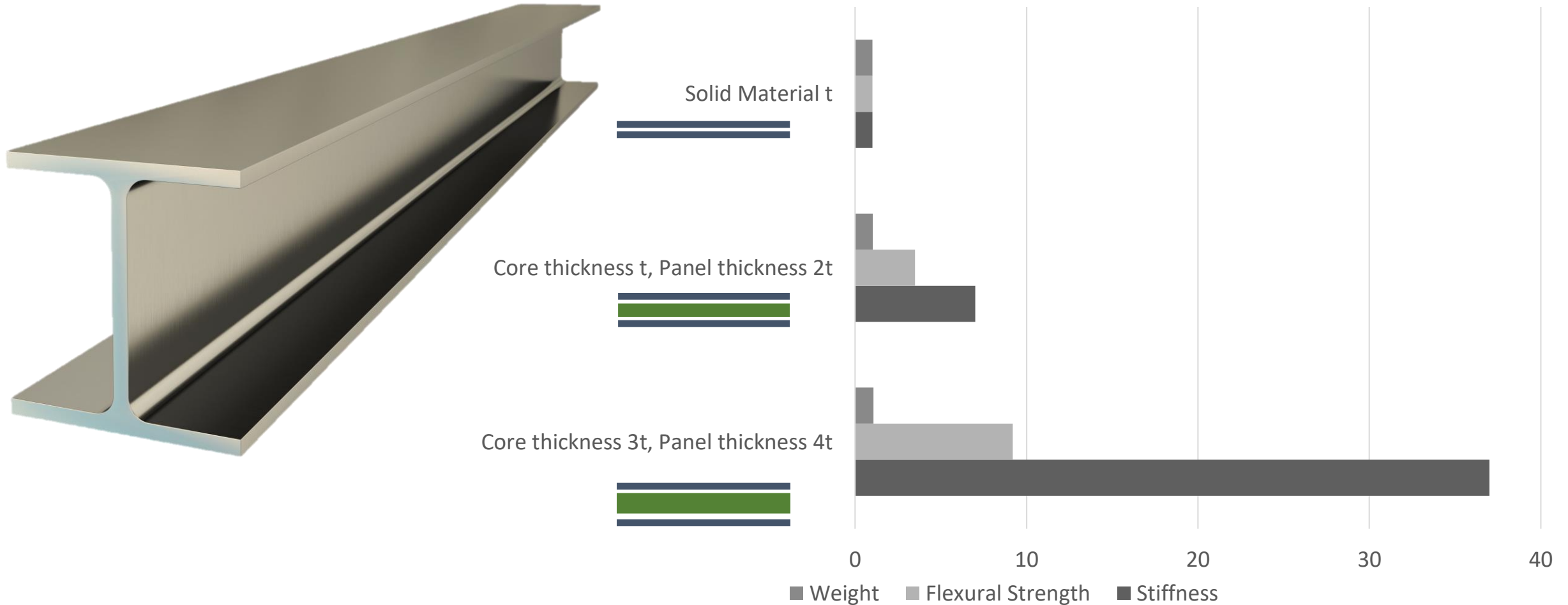
CORE MATERIAL

FIBER REINFORCED FACESHEETS

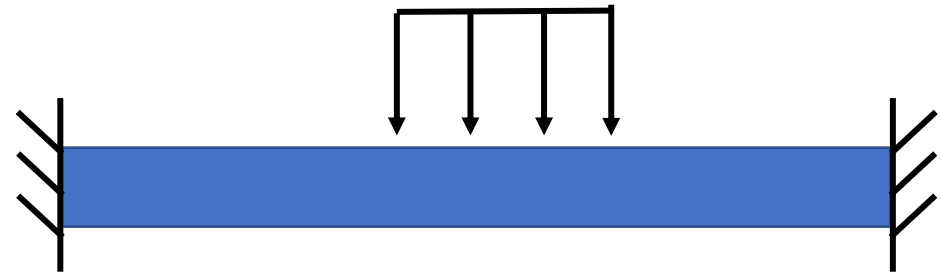
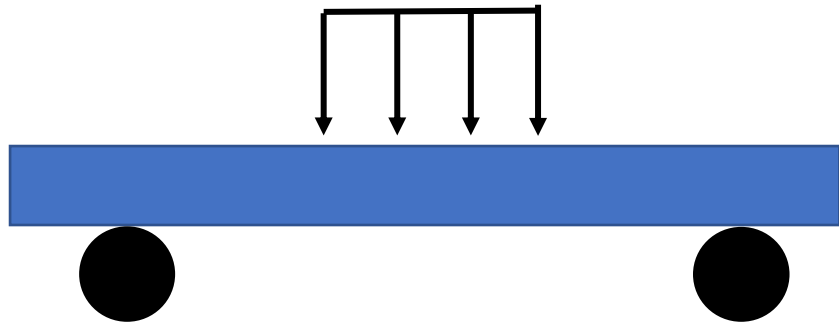




# BENEFITS OF SANDWICH PANELS

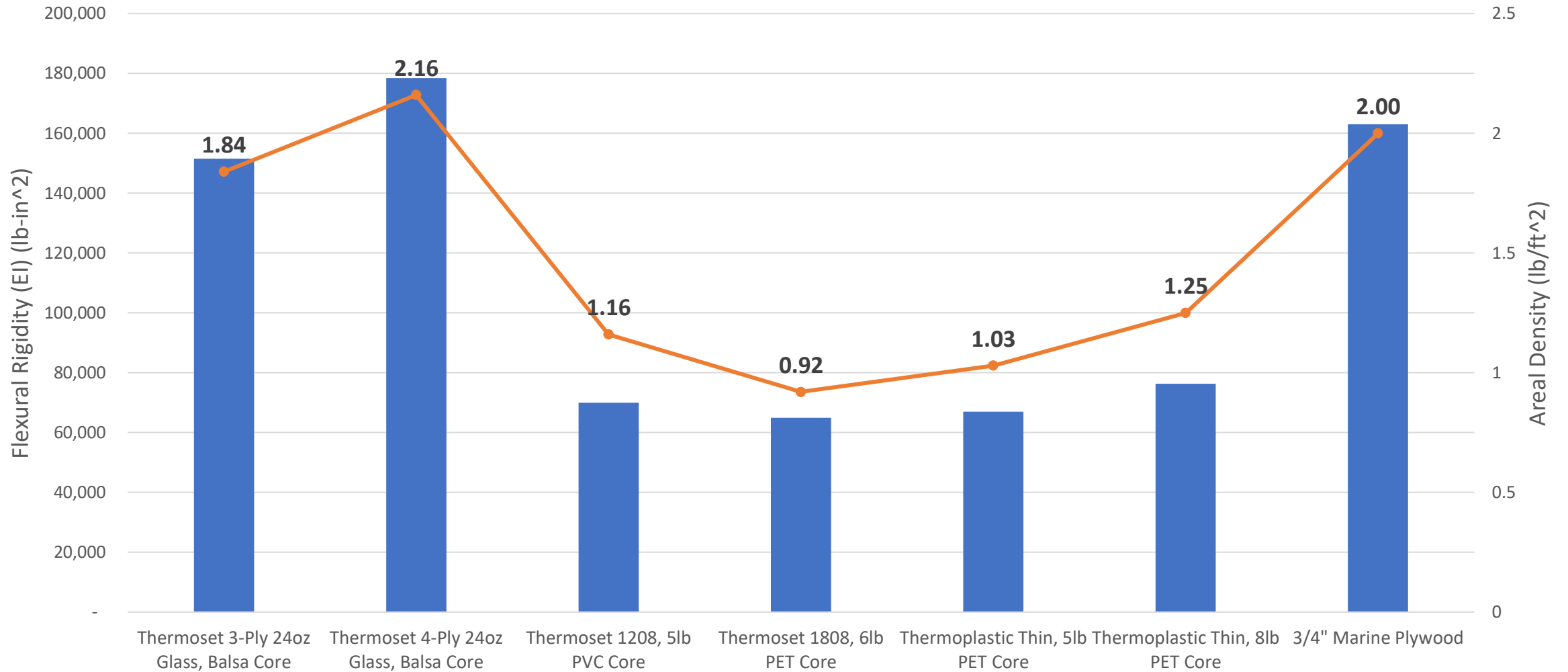


# WHAT IS FLEXURAL RIGIDITY?

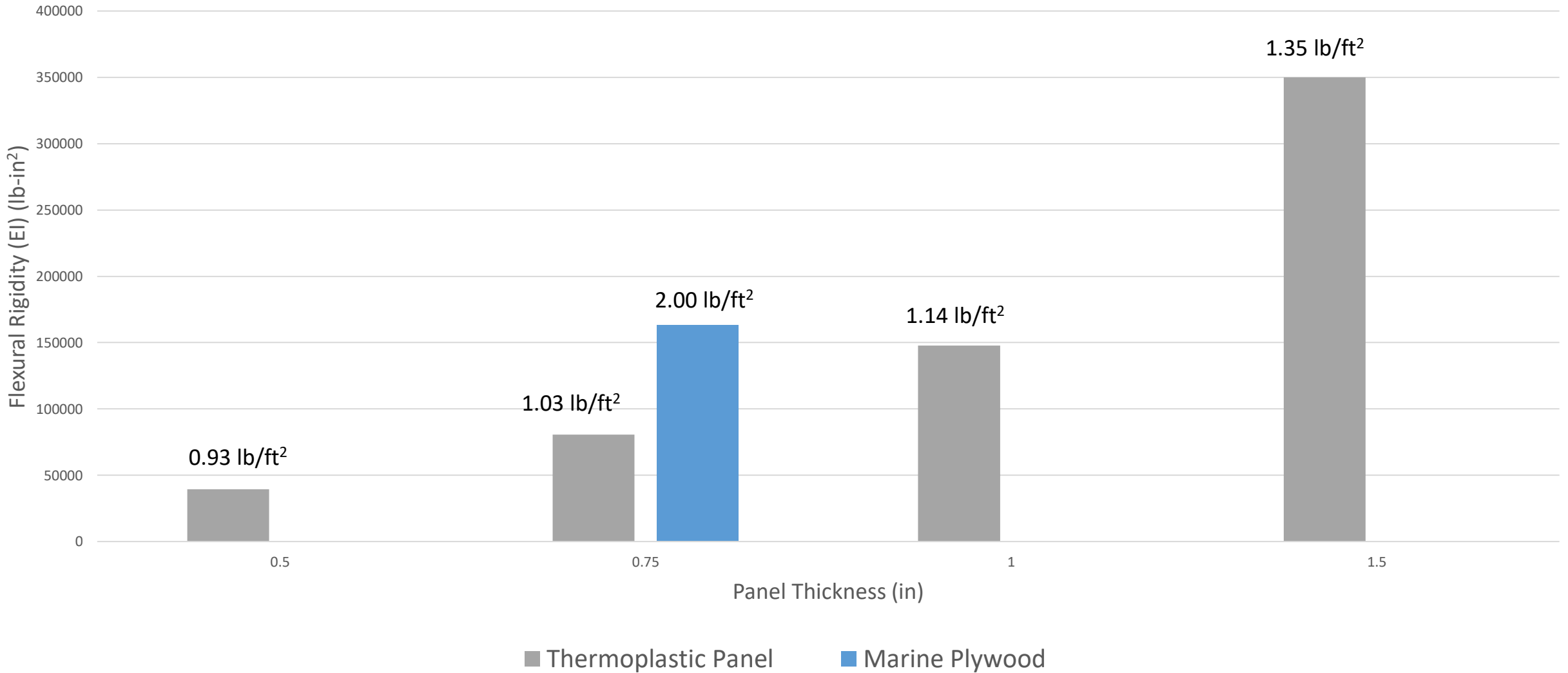




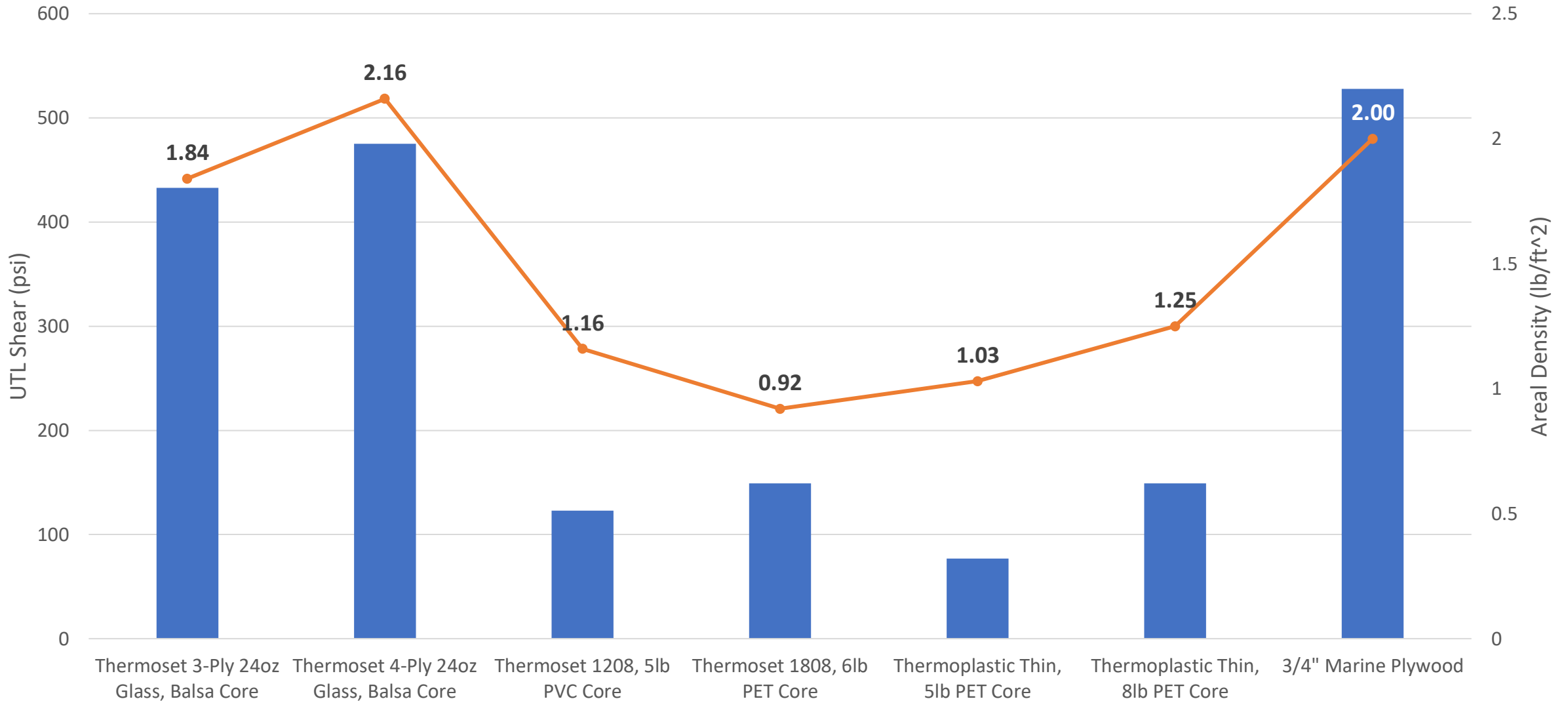
# FLEXURAL LOADING – ASTM D7249



# FLEXURAL RIGIDITY VS. THICKNESS – ASTM D7249



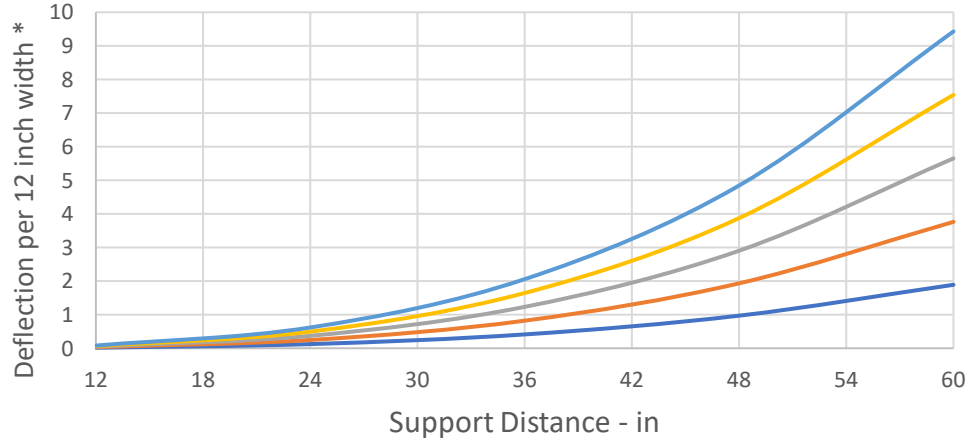
# SHEAR LOADING – ASTM C393



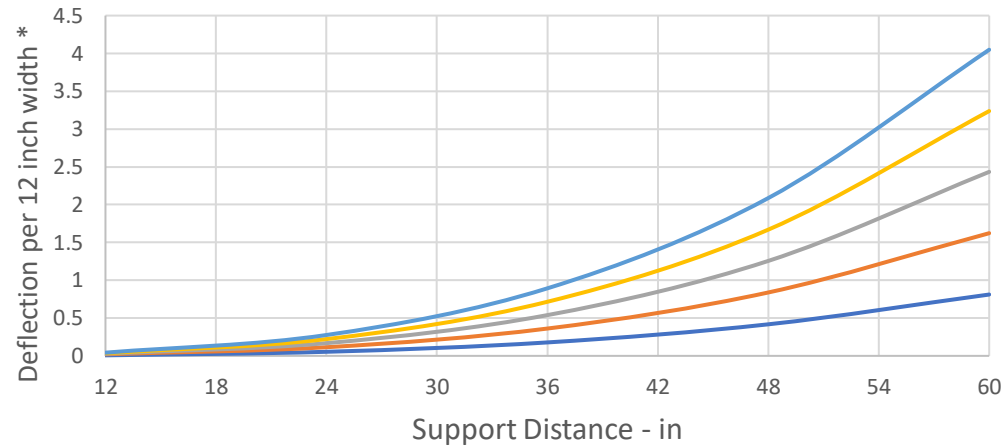


# 5.3 LB/IN<sup>3</sup> CORE DENSITY – SIMPLY SUPPORTED

**1/2" Thermoplastic Panel,**



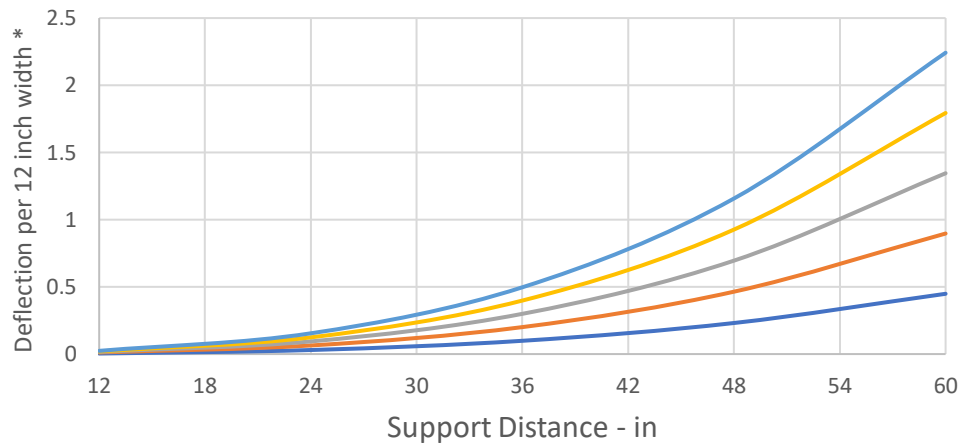
**3/4" Thermoplastic Panel**



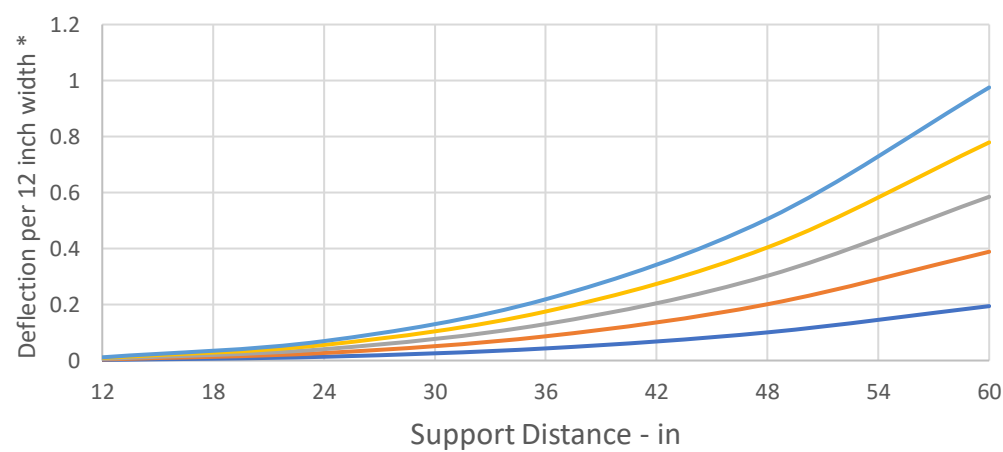
- 50 lb
- 100 lb
- 150 lb
- 200 lb
- 250 lb



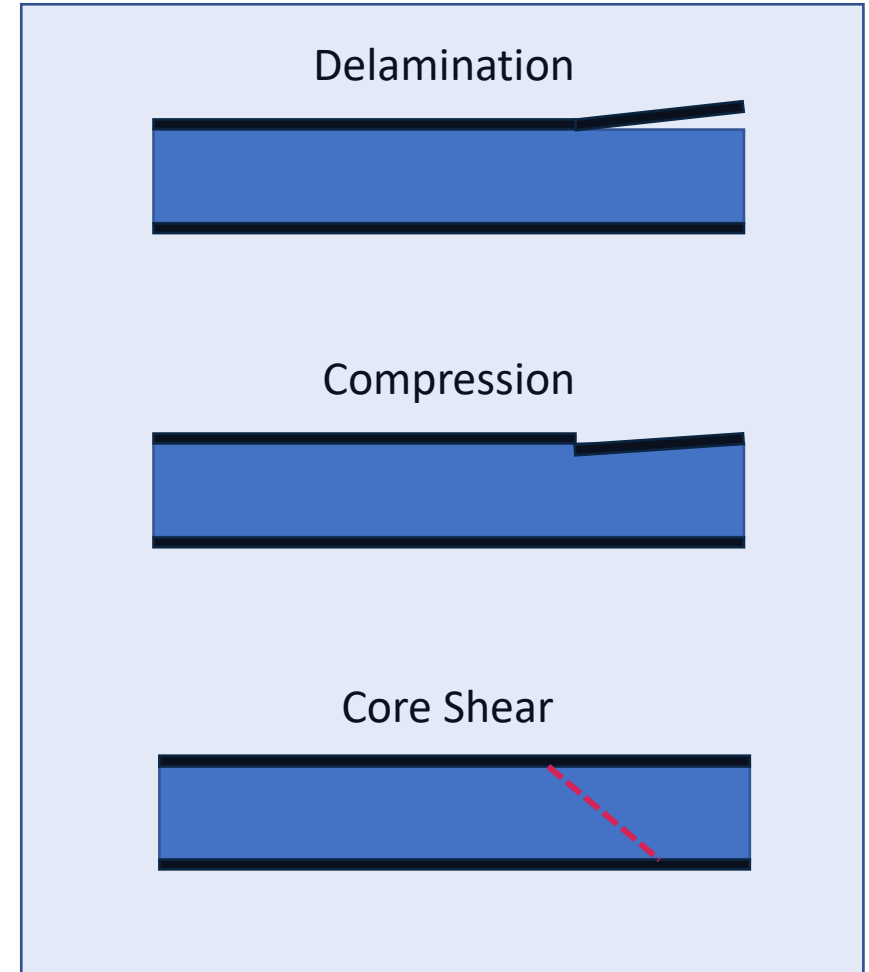
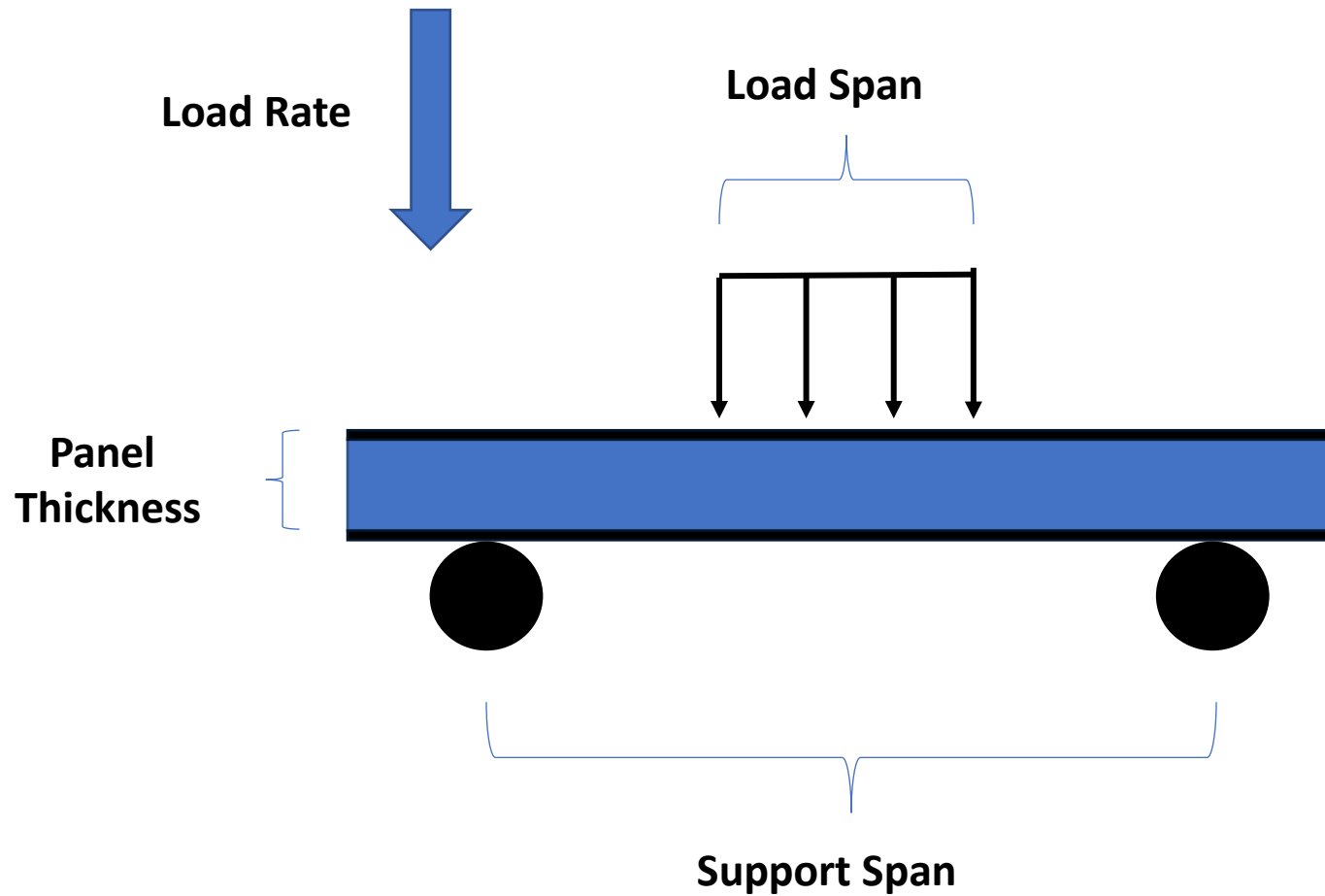
**1" Thermoplastic Panel**



**1-1/2" Thermoplastic Panel**



# PANEL TESTING CONDITIONS AND FAILURES



# PANEL TESTING EXAMPLES

Delamination



Skin Delamination



Skin Compression Failure

Compression





# PANEL TESTING EXAMPLES



Compound failures due to extreme deflection

Delamination



Core Shear



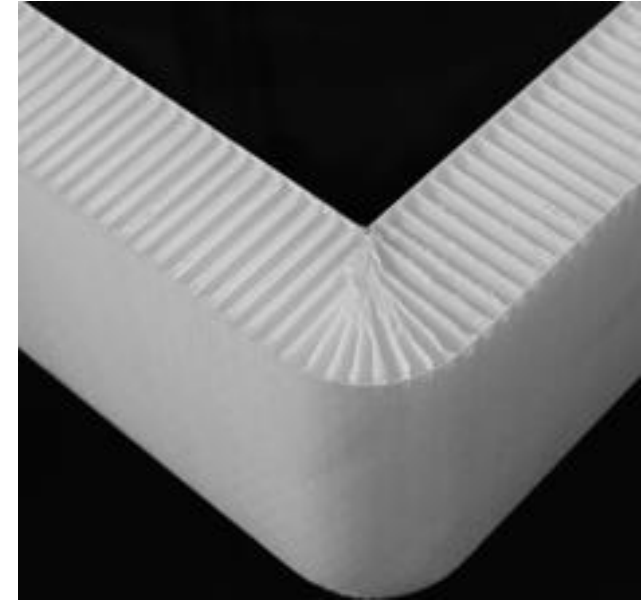
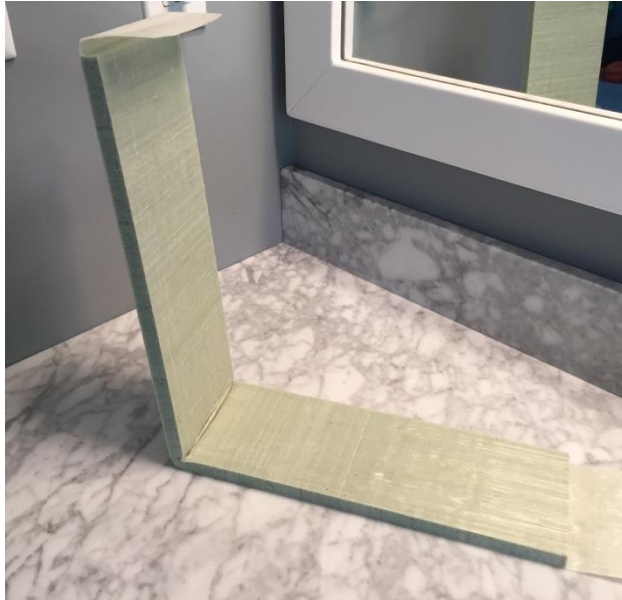
# PANEL TESTING EXAMPLES



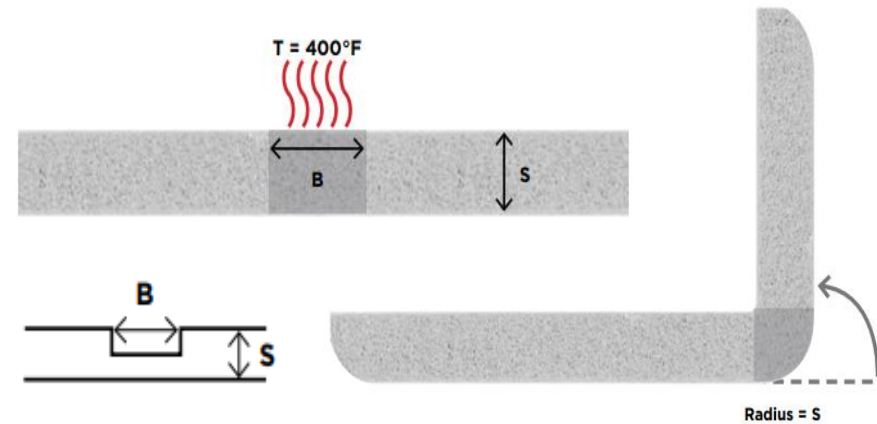




# POST-FORMING



$$\text{Heat Length} = \frac{\pi}{2 * \text{Thickness}}$$



# APPLICATIONS



## MARINE

Stringers, Bulkheads, Decking, Hatches, Covers, Cabinetry



## RECREATIONAL VEHICLES

Ceilings, Cabinetry, Load Floors, Sidewalls



## TRUCKS + TRAILERS

Trailer Floors & Liners, Aerodynamic Components, Cargo Containers



## RAIL

Doors, Floors, Interior Panels





# AIR CARGO CONTAINER

UNIT LOAD DEVICE (ULD)

## METAL REPLACEMENT

### SOLUTION

- Polystrand™ thermoplastic honeycomb panels

### IMPACT

- Thermoplastic panels are impact resistant to sustain less damage than aluminum
- Any damage is easy to repair / patch in the field
- Reduced time out of service for repairs
- Reduced weight vs. aluminum for improved fuel economy

### CHALLENGES

- Aluminum wall panels dent and puncture easily
- Sharp edges = safety concern
- Repair time takes containers out of service
- Sought lighter weight solution

# THANK YOU

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WWW.POLYONE.COM/COMPOSITES

The PolyOne logo, featuring the word 'PolyOne' in a stylized, italicized serif font with a trademark symbol.

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