# Mastering Lightweight Solutions: Transforming the Polymer Industry with Omyasphere 900

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# Agenda

1. Challenges and Solutions
2. Microspheres / Lightweight Fillers Overview
3. Omyasphere 900 series: Hollow Glass Microspheres
4. Case Studies
    1. PP compound
    2. Thermosets
    3. LDPE Film
5. Summary

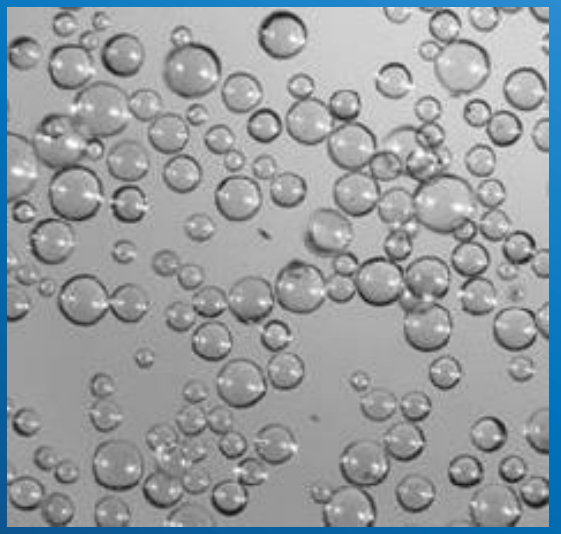
# Market Challenges

- Approximately 72% of **transportation-related emissions** are generated by road vehicles. As the global population grows, incomes rise, and mobility becomes more accessible, worldwide transportation demand is projected to increase significantly in the coming decades.
- The majority of countries have pledged to limit **global warming** to well below 2°C. The European Union has committed to reducing greenhouse gas emissions by at least 55% by 2030 and achieving climate neutrality by 2050.
- **Environmental and regulatory concern**, where there is a growing emphasis on sustainable and eco-friendly materials to reduce the overall **carbon footprint** in the applications.
- **Technological advancement and innovation** pressure creating the needs for advanced materials and rapid R&D to keep pace with the evolution in key market segments, such as electronics, automotive, aerospace and medical sectors.

# Solutions

- Widely adopted across diverse industries and applications, this **lightweighting solution** enables vehicle OEMs and Tier suppliers to **reduce emissions and lower the carbon footprint** associated with their sourced materials.
- Lightweighting vehicles, or specific vehicle components, is an effective strategy to **reduce fuel consumption, thereby lowering $CO_2$ emissions and decreasing the overall carbon footprint**.
- Accelerated and collaborative **R&D with OEMs**, encourage partnerships between material scientists, engineers, and industry experts from the target sectors identifying specific needs and the **development of tailored solutions**.
- Develop **High-Performance Lightweight Fillers** and focus on creating fillers that offer superior properties

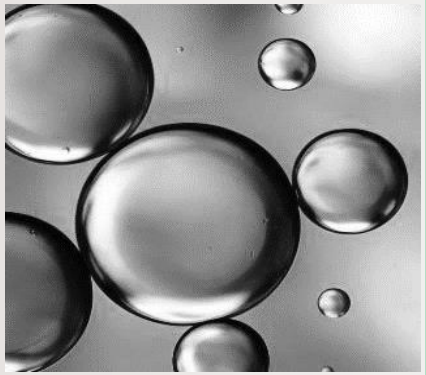
# Microspheres / Lightweight Fillers Overview



# Main Lightweight Fillers

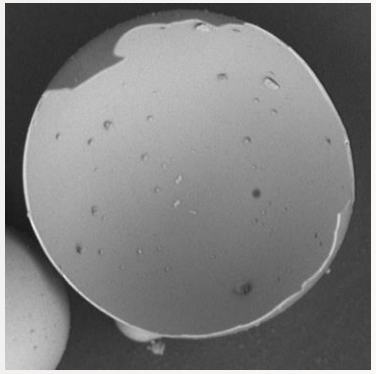
- ✓ True Density or Effective Particle Density <1 g/cc
- ✓ Hollow Structure, Microsphere
- ✓ Lightweighting and Insulating as main Function intended
- ✓ Other suitable Functions (e.g. rheology enhancer, dielectric properties improvement)

**Hollow Glass**



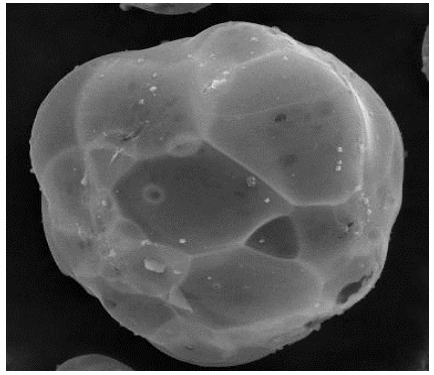
**Omyasphere 900 Series**

**Cenospheres**

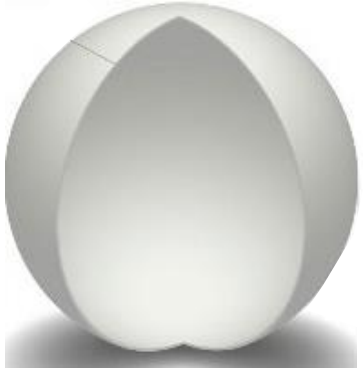


**Expanded Glass**

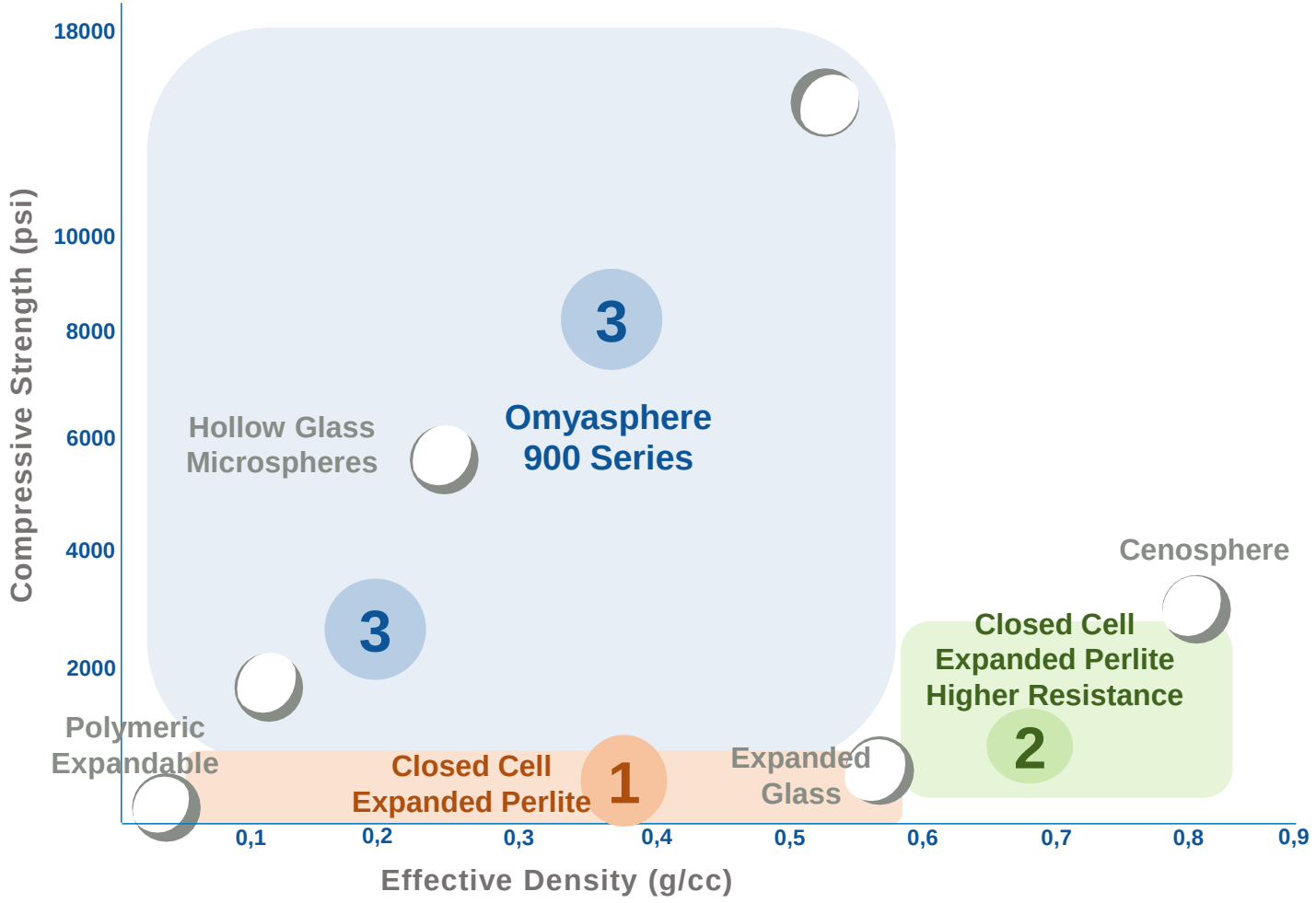
**Closed-Cell Expanded Perlite**



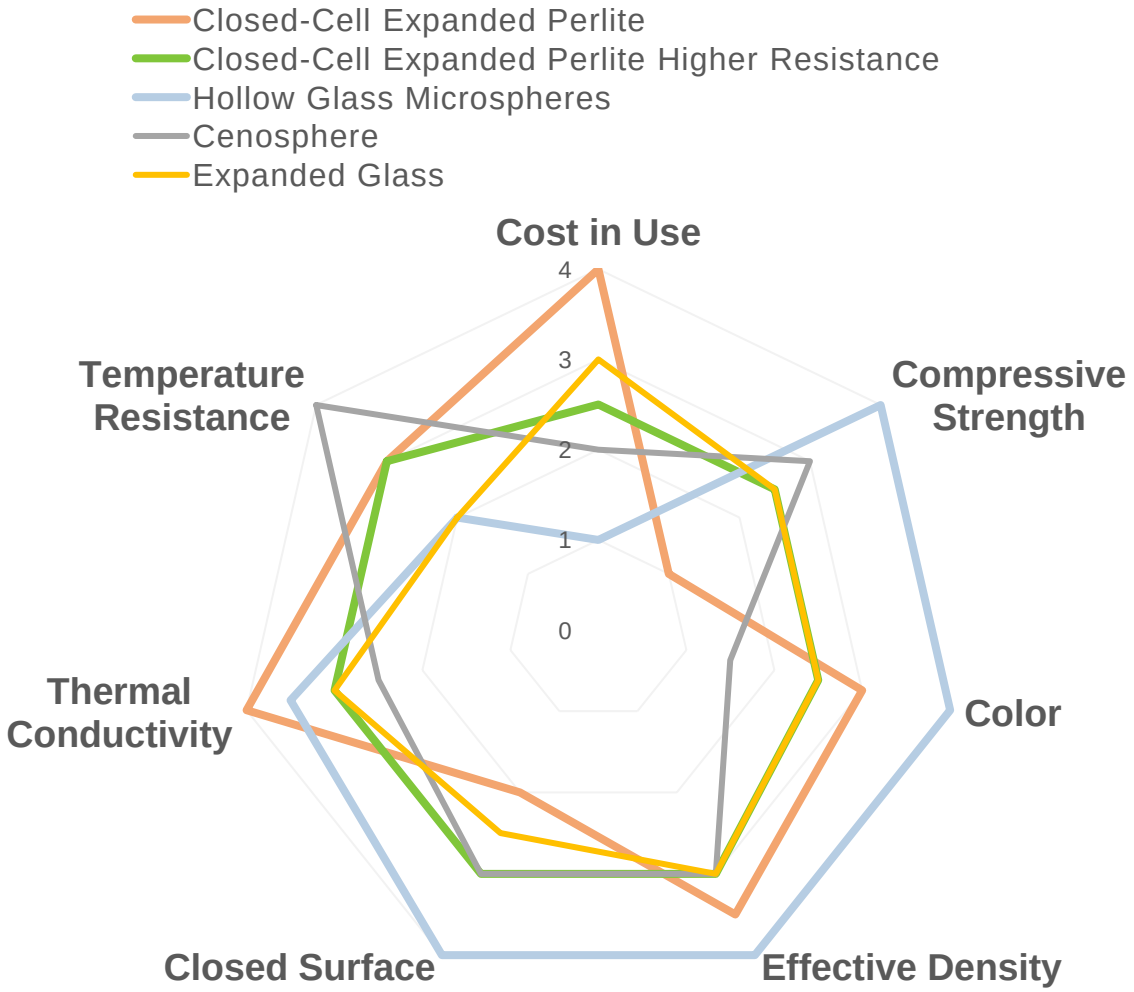
**Polymeric**



# Omyasphere Positioning (according to density and strength)



# Comparison




**Application, Functionality and Cost-in-use leads to Suitable Microsphere Selection**


# Omyasphere 900 Series

Hollow Glass Microspheres

# Key Attributes and Benefits

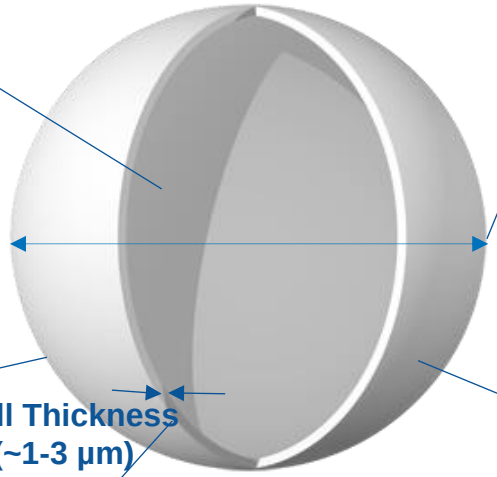
## Hollow

Low density

Low thermal conductivity

Light scattering

Low dielectric permittivity



Wall Thickness
(~1-3 µm)

## Spherical

Low surface to volume ratio

Higher filler loading

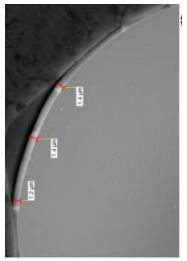
Isotropic behavior

Free flowing


## Hermetic

Low absorption

Improved stability over time



## Strength

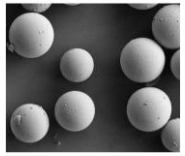
Reduced breakage

High shear/ pressure resistance

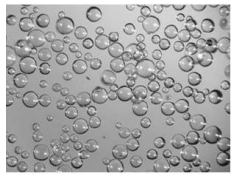
## Borosilicate

Hard surface

Water stable



## Brightness



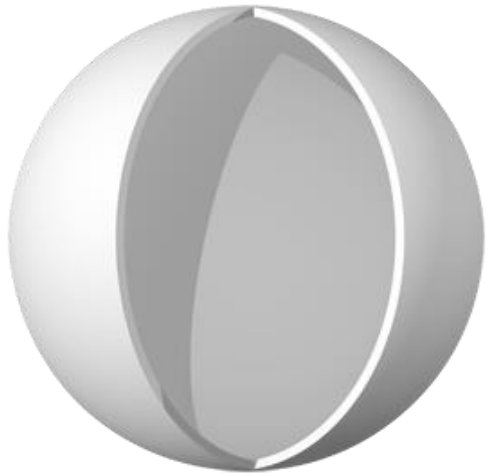
White appearance

Light scattering

Surface properties

# Typical Properties

| Omyasphere 900 series | |
|---|---|
| Appearance | **White powder, good fluidity** |
| Composition | **Soda-lime borosilicate** |
| True Density | **0.15-0.6 g/cm$^3$** |
| Bulk Density | **0.09-0.32 g/cm$^3$** |
| Particle Size | **≤ 120 µm** |
| Compressive strength | **500-28000 psi** |
| pH | **8 - 9.5** |
| Thermal Conductivity | **0.04-0.09 W/m.K** |
| Dielectric Constant (@100MHz) | **1.2 - 1.8** |
| Hardness (Mohs Scale) | **~5** |
| Softening (ºC) | **~600** |

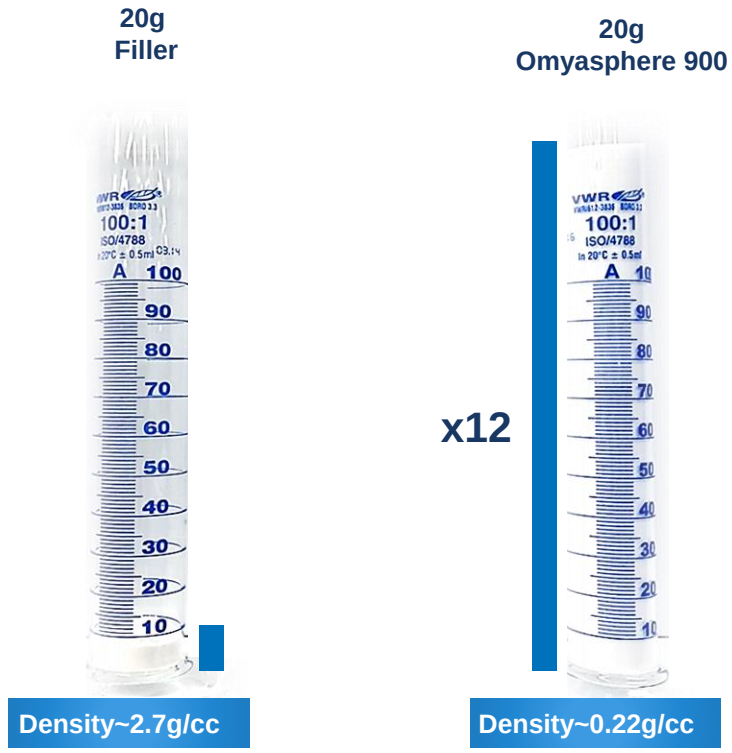


# LWF Density – Volume Approach

**Approaching LWF by volume rather than by weight.**

**Density makes the difference…**

| Filler | Density [g/cc] |
|---|---|
| Barium Sulfate | 4.5 |
| Titanium Dioxide | 4.2 |
| Talc | 2.8 |
| Calcium Carbonate | 2.7 |
| Ceramic Microspheres | 2.5 |
| Cenospheres | <0.95 |
| Expanded Glass | <0.8 |




**LWF comparison on a volume basis, not by weight.**
**Replacement on a weight basis will lead to formulation issues (oversaturating the system)**

# Portfolio for Polymers Applications

| Applications | Bowling Ball | Cast Polyester | Potting Compounds | Tooling Boards | Putties | Sheet Molding Compound (SMC) | Compounding | Injection | Extrusion | Deep Sea Pipe Insulation | Pultrusion | Sprayable Syntactic Foam | Buoyancy | Spray Lay Up | Thermoplastics | Elastomers | Rubber | Shoe Material | Sensitizer for Bulk & Packaged Emulsion |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Omyasphere 915-CNZ | ● | ● | ● | ● | ● | | | | | ● | | | | | | | | | ● |
| Omyasphere 920-CNZ | | | | | | | | | | | | | | | | | | | ● |
| Omyasphere 932-CNZ | | | | | | | | | | | | | | | | | | | ● |
| Omyasphere 938-CNZ | | | | | | | | | | | | | | | | | | | ● |
| Omyasphere 960-CNZ | | | | | | | ● | ● | | | | | | | | | | | |
| Omyasphere 922 S-CNZ | ● | ● | ● | ● | | | | | | | | | ● | | | | | | ● |
| Omyasphere 928 S-CNZ | | | | | | | | | | | | | | | | | | | ● |
| Omyasphere 938 S-CNZ | | | | | | ● | ● | ● | | ● | ● | ● | ● | ● | ● | ● | | | |
| Omyasphere 942 S-CNZ | | | | | | | | ● | ● | | | | | | | | ● | ● | |
| Omyasphere 960 S-CNZ | | | | | | | ● | ● | | | | | | | | | | | |
| Omyasphere 960 SH-CNZ | | | | | | | ● | ● | ● | | | | | | | | | | |

●Suitable

**Particle size (processing) and strength (survival rate) as key drivers for selecting right product**

# Complete Offering

| | Bulk Density [g/cm³] | True Density [g/cm³] | Compressive Strength [MPa/Psi] | D50 [µm] | D90 [µm] |
|---|---|---|---|---|---|
| **Omyasphere 915 - CNZ** | 0.09 | 0.15 | 4 / 500 | 85 | 120 |
| **Omyasphere 920 - CNZ** | 0.11 | 0.20 | 4 / 500 | 65 | 110 |
| **Omyasphere 925 - CNZ** | 0.14 | 0.25 | 5 / 750 | 65 | 100 |
| **Omyasphere 930 - CNZ** | 0.17 | 0.30 | 10 / 1500 | 55 | 85 |
| **Omyasphere 932 - CNZ** | 0.18 | 0.32 | 14 / 2000 | 45 | 80 |
| **Omyasphere 935 - CNZ** | 0.20 | 0.35 | 21 / 3000 | 40 | 70 |
| **Omyasphere 938 - CNZ** | 0.21 | 0.38 | 38 / 5500 | 40 | 65 |
| **Omyasphere 940 - CNZ** | 0.21 | 0.40 | 28 / 4000 | 40 | 70 |
| **Omyasphere 942 - CNZ** | 0.23 | 0.42 | 55 / 8000 | 40 | 60 |
| **Omyasphere 946 - CNZ** | 0.25 | 0.46 | 41 / 6000 | 40 | 70 |
| **Omyasphere 950 - CNZ** | 0.26 | 0.50 | 55 / 8000 | 40 | 60 |
| **Omyasphere 960 - CNZ** | 0.32 | 0.60 | 83 / 12000 | 40 | 65 |

| | Bulk Density [g/cm³] | True Density [g/cm³] | Compressive Strength [MPa/Psi] | D50 [µm] | D90 [µm] |
|---|---|---|---|---|---|
| **Omyasphere 920 S - CNZ** | 0.11 | 0.20 | 7 / 1000 | 60 | 90 |
| **Omyasphere 922 S - CNZ** | 0.12 | 0.22 | 8 / 1200 | 45 | 70 |
| **Omyasphere 928 S - CNZ** | 0.16 | 0.28 | 28 / 4000 | 45 | 65 |
| **Omyasphere 938 S - CNZ** | 0.21 | 0.38 | 38 / 5500 | 30 | 50 |
| **Omyasphere 942 S - CNZ** | 0.23 | 0.42 | 55 / 8000 | 25 | 40 |
| **Omyasphere 960 S - CNZ** | 0.32 | 0.60 | 124 / 18000 | 35 | 55 |
| **Omyasphere 960 SH - CNZ** | 0.31 | 0.60 | 193 / 28000 | 16 | 25 |

# Key Targeted Applications


**Other applications: Putties, Casting, Tooling Boards, Electronics…**

# What could you achieve with Omyasphere 900? (depending on the application)

- **Weight reduction**
  - Omyasphere reduces **weight from 10% up to 50%** leading to **transportation cost savings**, improved environmental sustainability through better fuel economy
- **Improved Rheological properties**
  - Omyasphere **sphericity** leads to lower viscosity allowing **higher filler loading**
- **Enhanced Dimensional stability**
  - Due to more **uniform stress distribution** (isotropic behavior) reduces shrinkage / warpage therefore reduces **rejects and reprocessing**
- **Thermal management**
  - Reduced **thermal conductivity** increase **cooling rates** (effect of thermal diffusivity)
- **Dielectric property improvement**
  - Improved signal and **data transfer** (e.g. printed circuits, connectors)

# Key Features in some applications

**Sheet Molding Compound**

- ✓ Weight reduction of up to 40%
- ✓ Enhanced Dimensional stability (warping reduction)
- ✓ Improve thermal insulation
- ✓ Reduced dielectric constant

**Omyasphere 938 S**

**Injection molding and extrusion applications**

- ✓ Weight reduction of up to 15%
- ✓ Contribute to sustainability through better fuel economy
- ✓ Productivity gains due faster cooling, profile extrusion
- ✓ Enhanced Dimensional stability

**Omyasphere 960 S**
**Omyasphere 960 SH**
**Omyasphere 942 S**

**Buoyancy aids**

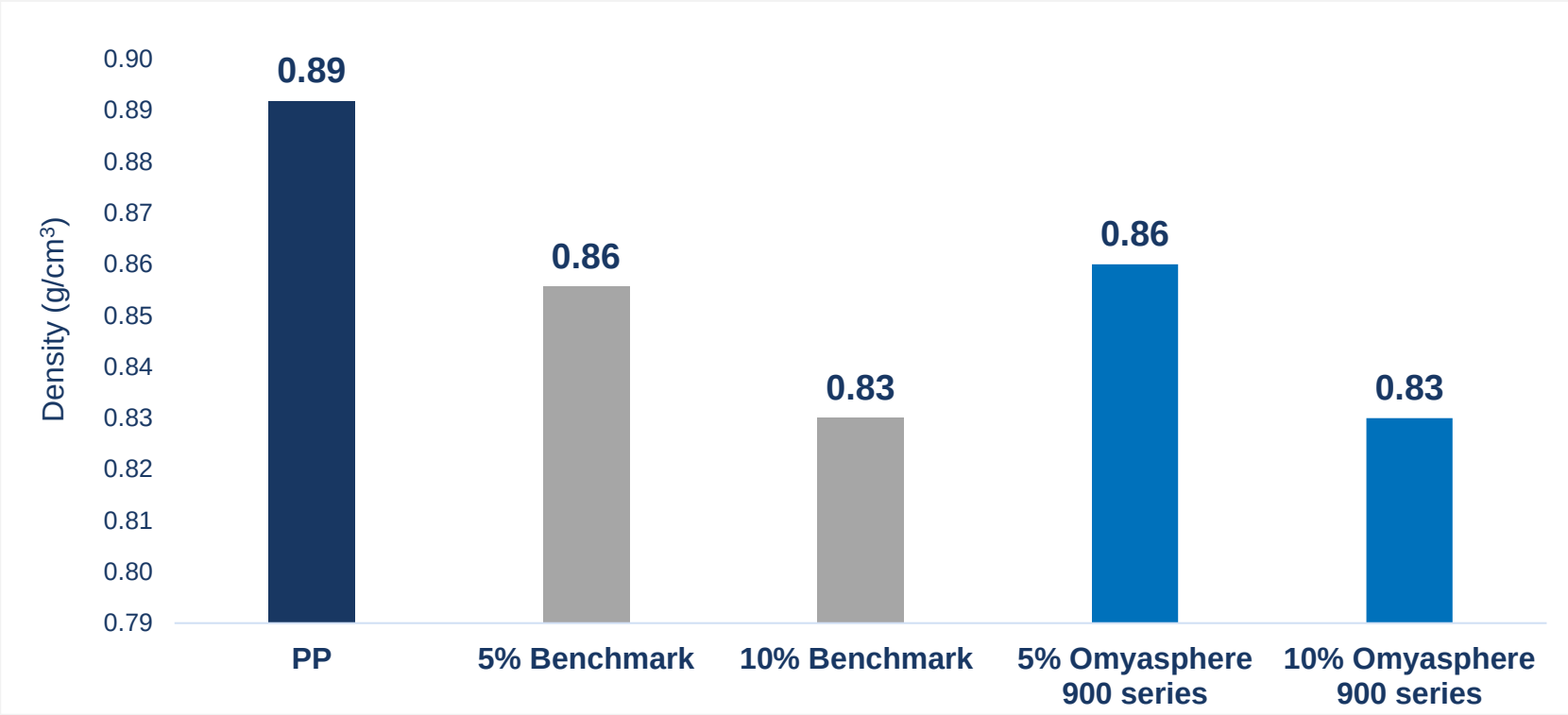
- ✓ Weight reduction of up to 50%
- ✓ Low thermal expansion
- ✓ Enhanced dimensional stability
- ✓ Greater thermal insulation
- ✓ Reduced dielectric constant

**Omyasphere 928 S**
**Omyasphere 938 / 938 S**
**Omyasphere 922 S**

**Omyasphere 900 selection according to strength (survival rate) particle size (processing) and % loading (balance between density reduction, mechanical properties and processing characteristics)**

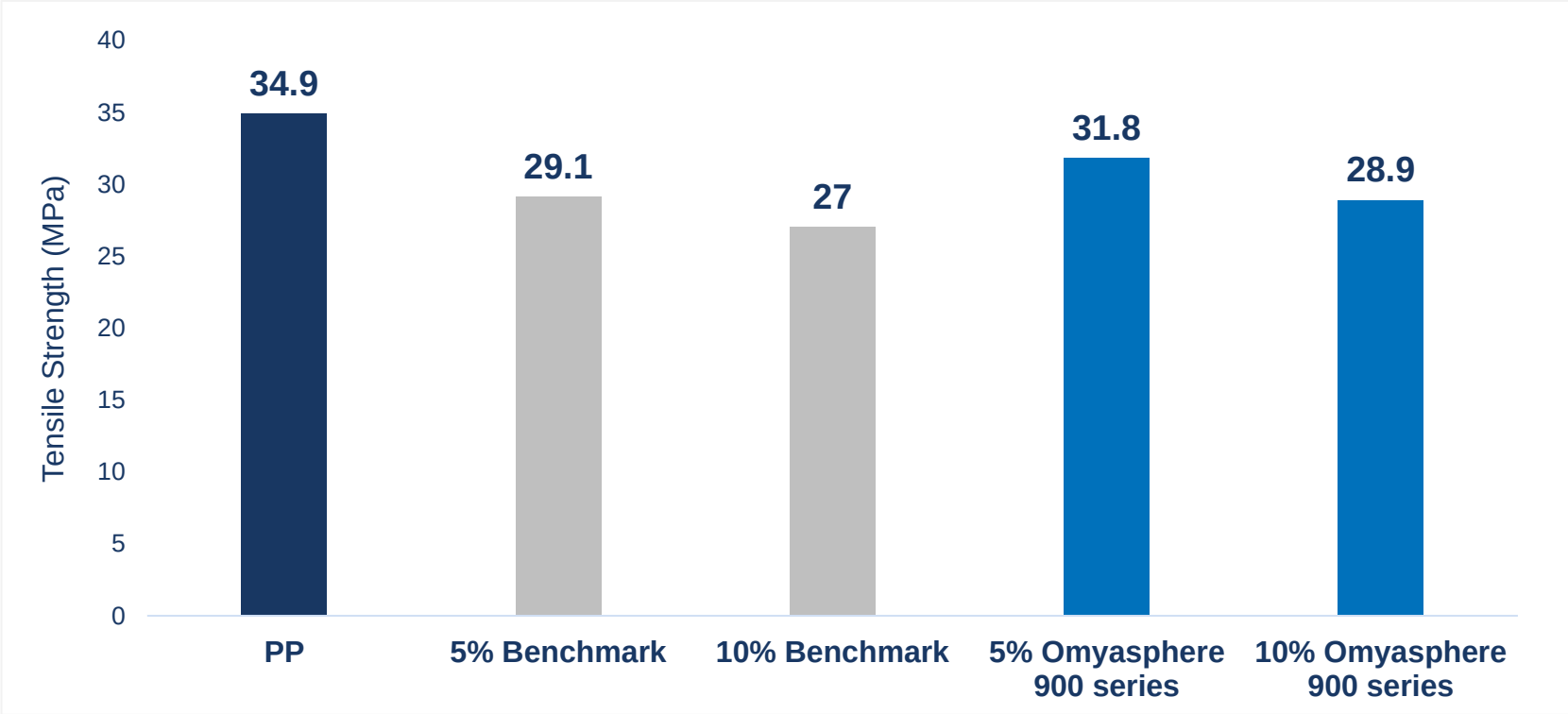
# Case Studies

# PP Compound – Density



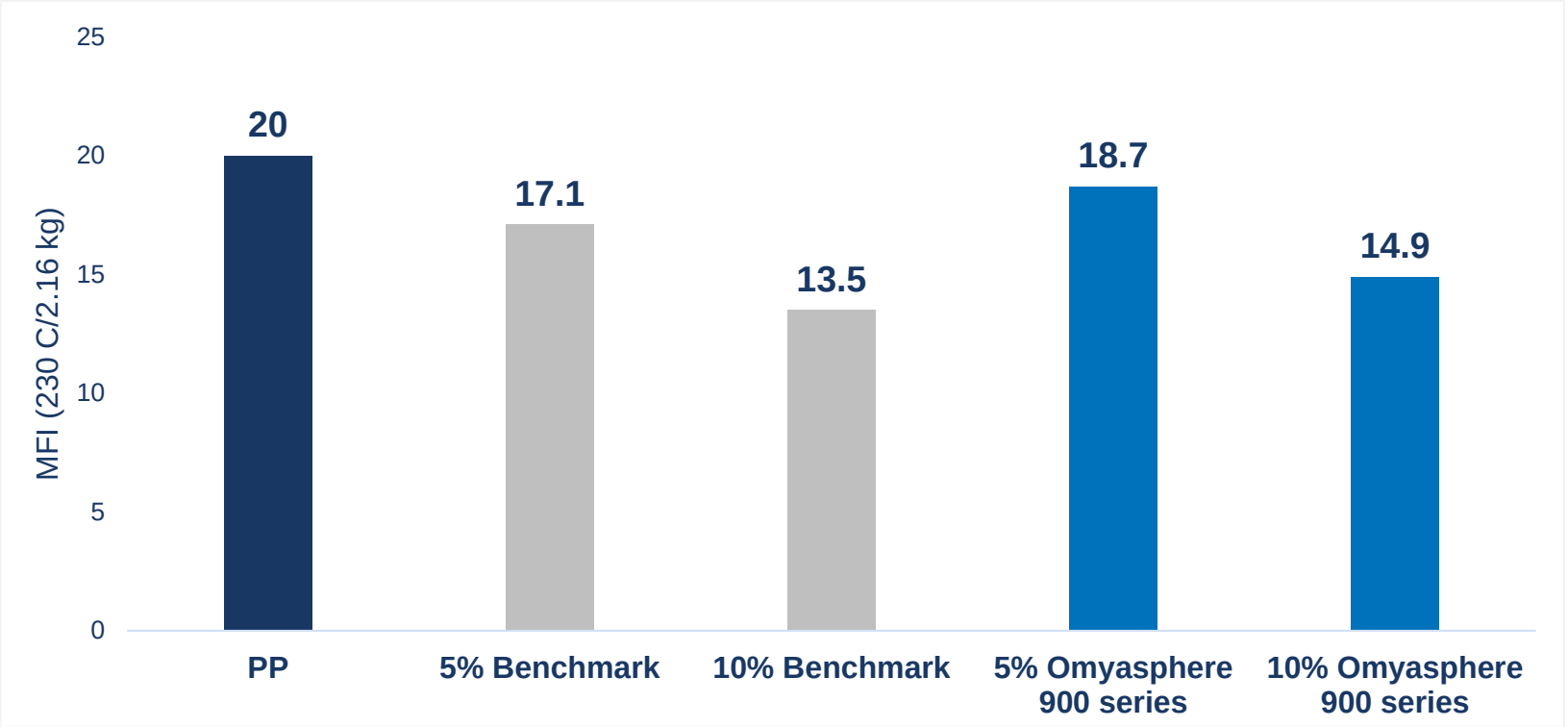

**Omyasphere 900 showed equivalent density reductions vs benchmark**

# PP Compound – Tensile Strength



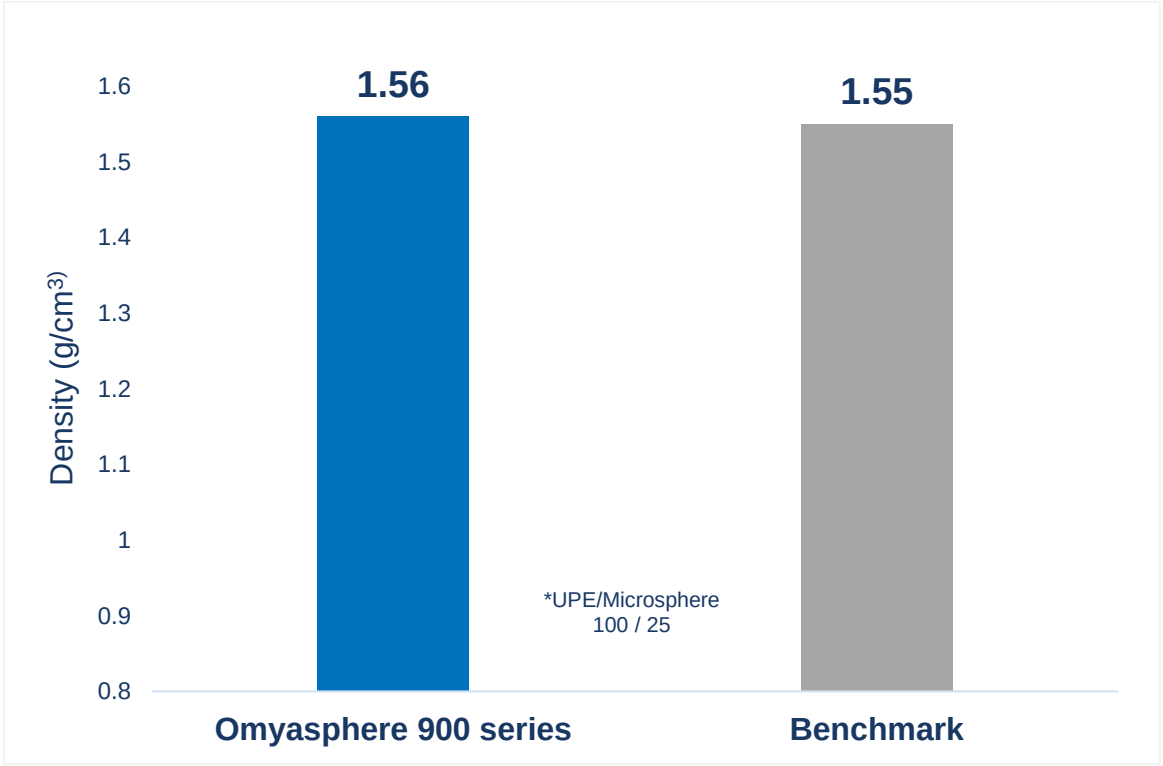

**Omyasphere 900 showed equivalent tensile strength vs benchmark**

# PP Compound - MFI



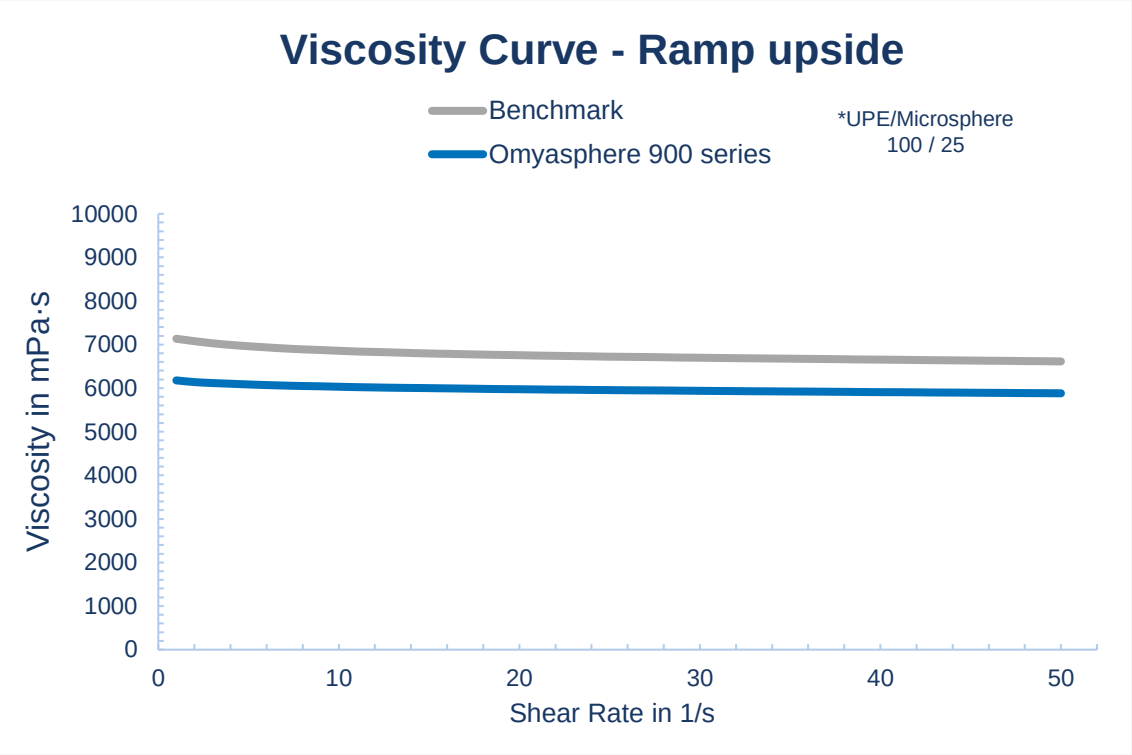

**Omyasphere 900 showed equivalent rheology vs benchmark**

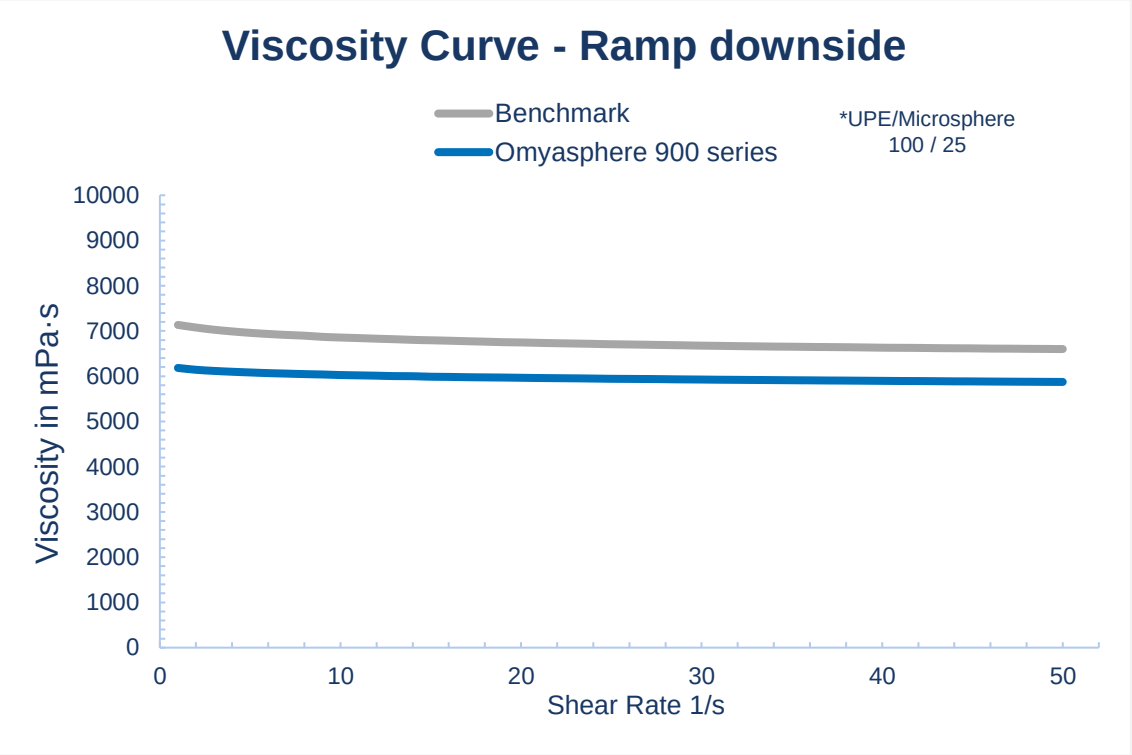
# Thermoset - Density




**Omyasphere 900 showed equivalent density reduction vs benchmark**

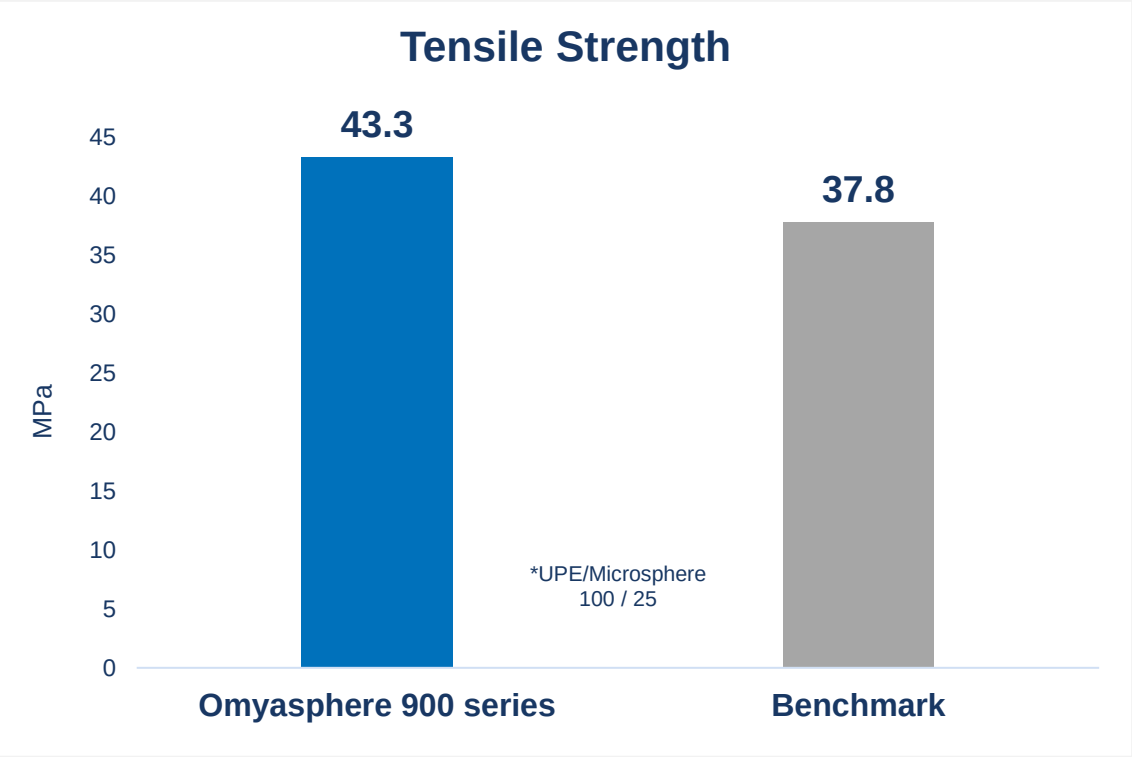
# Thermoset - Viscosity

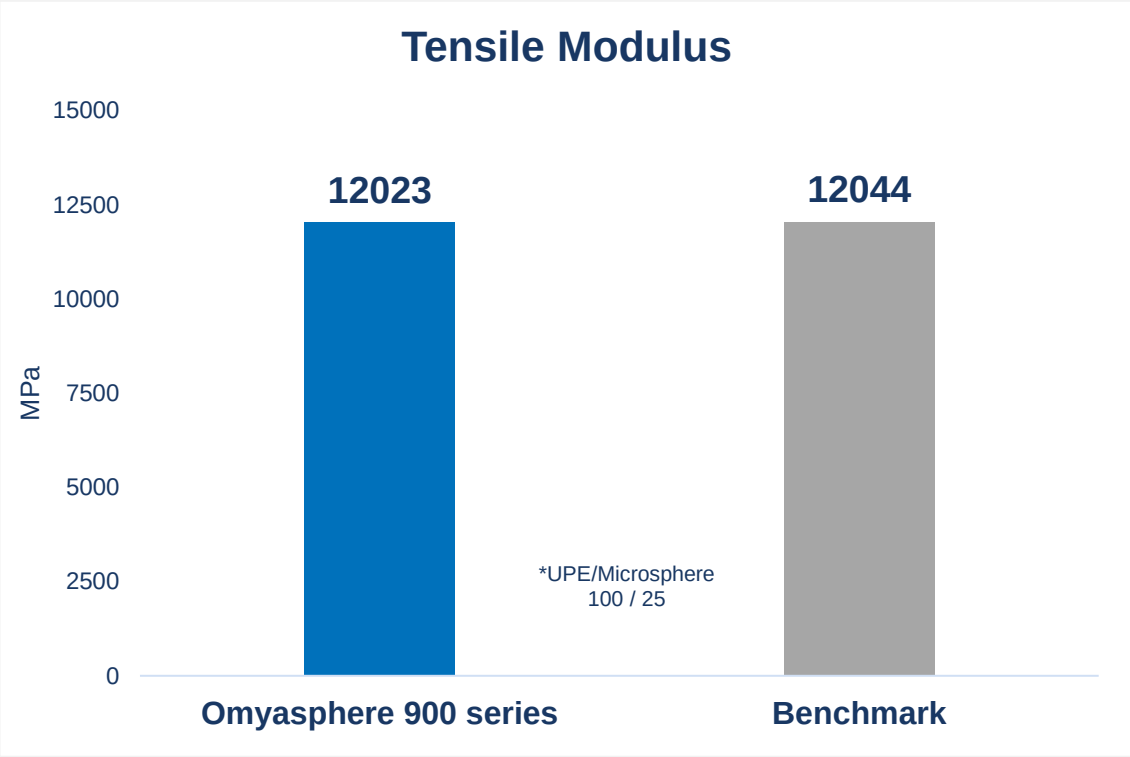



**Omyasphere 900 showed slightly lower viscosity vs benchmark**

# Thermoset – Mechanical Properties

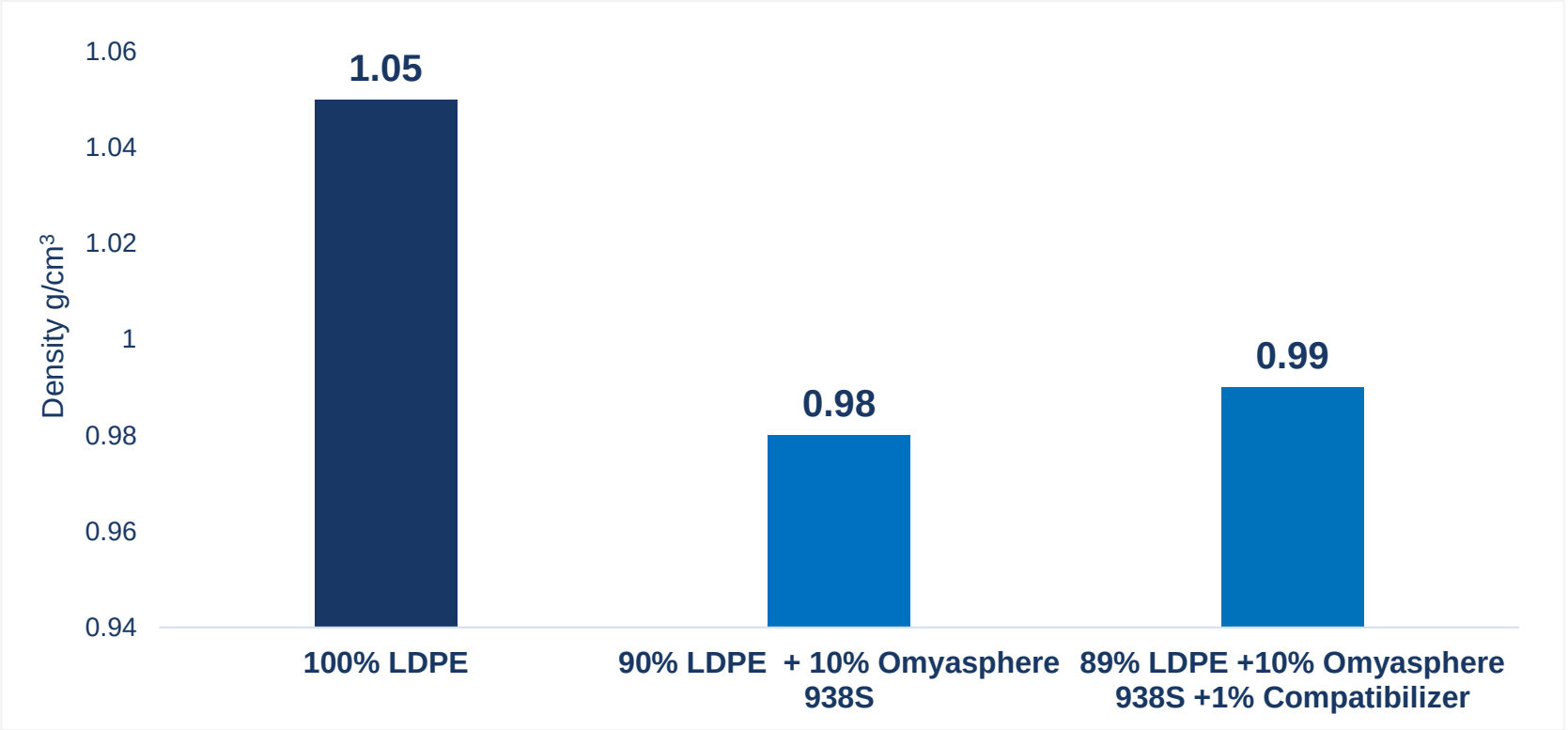



**Omyasphere 900 showed slightly higher tensile strength and equivalent modulus vs benchmark**

Case Study - LDPE

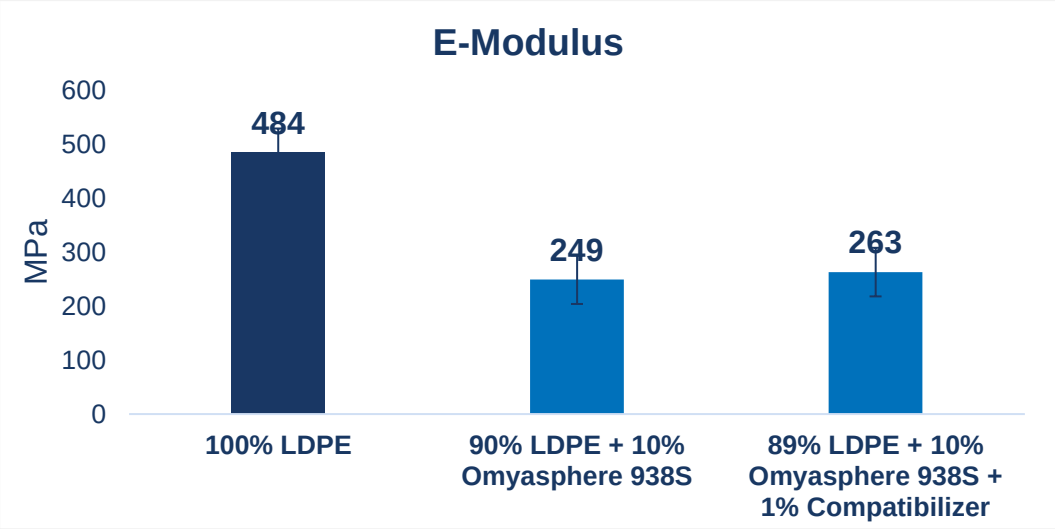
# LDPE Film - Density

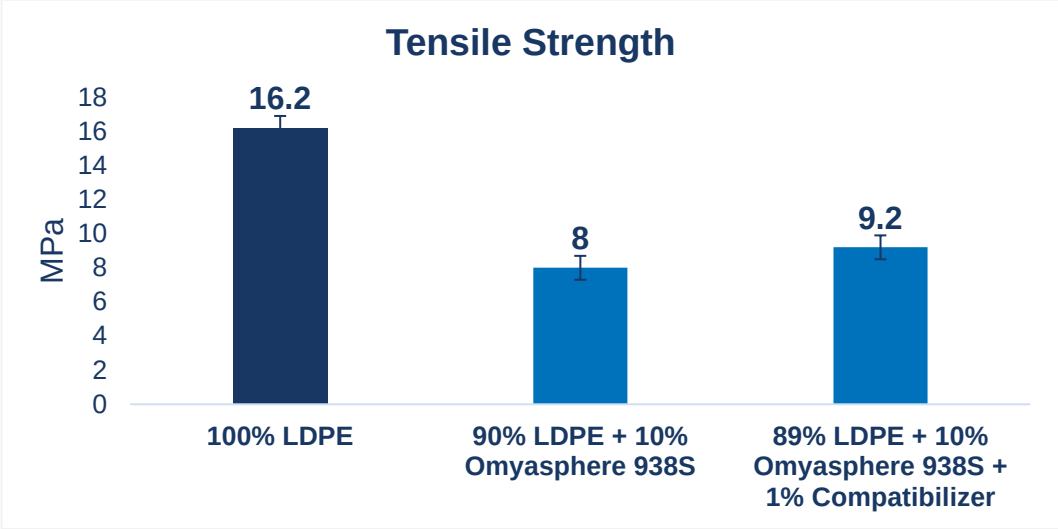


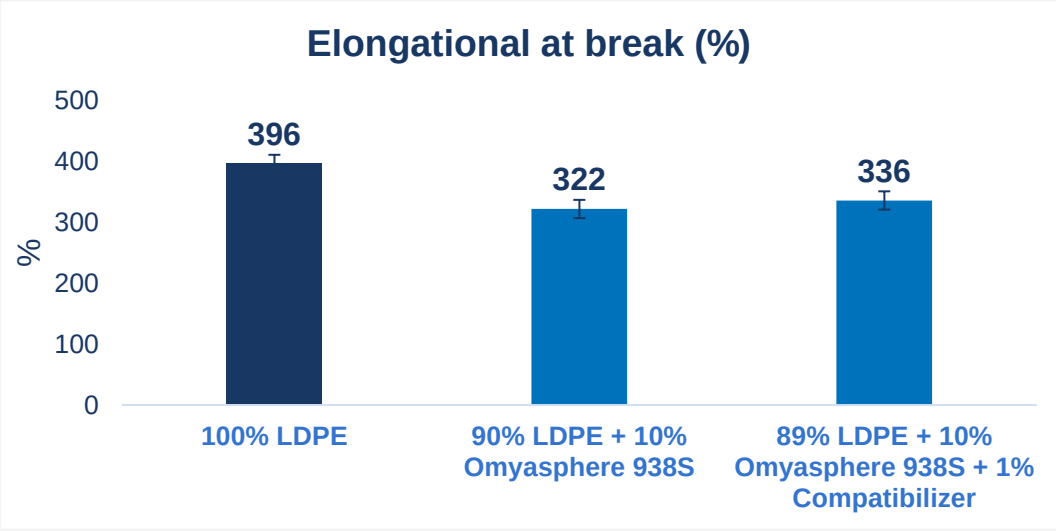

**Omyasphere 900 showed 5% density reductions vs reference**

Case Study - LDPE

# LDPE Film - Mechanical Properties



# Summary

# Summary

**Omyasphere 900 selection according to strength (survival rate) particle size (processing) and loading (balance between density, mechanical properties and processing characteristics)**

**Omyasphere 900 hollow glass microspheres** lead to tangible savings:

- ✓ **Weight Reduction** ➡ leads to **transportation cost savings**, improved environmental sustainability through **better fuel economy**
- ✓ **Improved rheological** properties ➡ reduced viscosity build up allowing **higher filler loading**
- ✓ Enhanced **dimensional stability** ➡ **reducing rejections** and reprocessing
- ✓ Enhanced **thermal management** ➡ **faster cooling**
- ✓ Improved **Dielectric properties** ➡ improved **signal and transfer** data

**Omyasphere 900 enhancing key Megatrends: Lightweighting, Energy Cost Savings, Low Emissions**


# Make Your Life Easier with Omyasphere: LWF solutions

**Visit our Website for Lightweight Fillers:**
lightweightfillers.omya.com

**Get in Contact for technical questions:**

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