Cooling Energy Savings using Microspheres Enhanced Thermal Insulation Coatings

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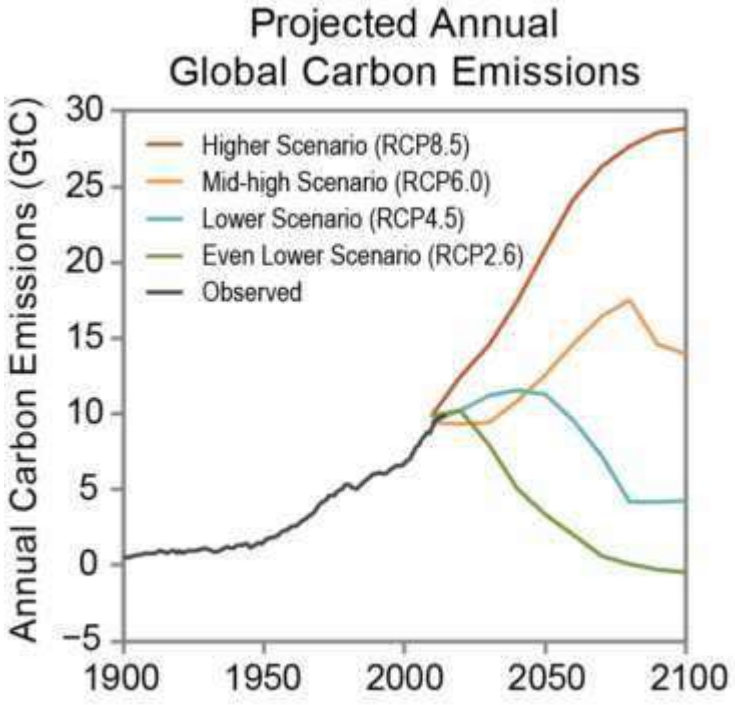
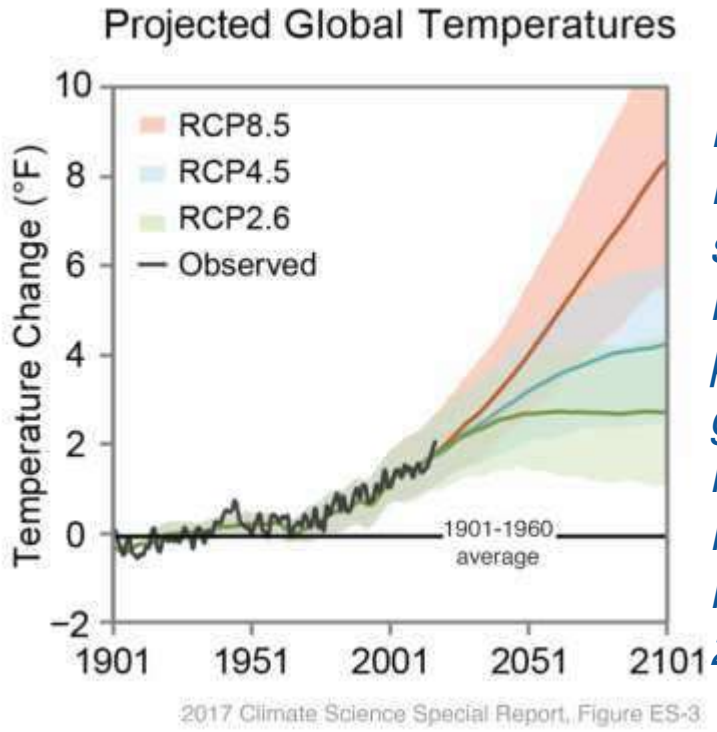
A Humanity Challenge: Climate Change

- Since the 1800s, human activities have been the main driver of climate change, primarily due to the burning of fossil fuels.
- Such process generates greenhouse gas emissions that act like a blanket wrapped around the Earth, trapping the sun's heat and raising temperatures.
- Reviewers agreed that limiting global temperature rise to 1,5°C would help us avoid the worst climate impacts and maintain a **livable climate**.

Past Data and Future Climate Scenarios and Projections

While temperature changes have not been consistent across the Earth, the overall increase in the globally averaged temperature indicates that **a greater number of regions are experiencing warming rather than cooling.**





2017 Climate Science Special Report, Figure ES-3

Representative Concentration Pathways or RCPs are scenarios used in climate modeling to represent different potential trajectories of future greenhouse gas concentrations in the Earth's atmosphere. Each representing a different level of radiative forcing by the year 2100.

Urban Heat Island: How to Adapt/Avoid?

- Air temperature in urban areas is systematically higher vis-à-vis their more natural surroundings. This difference in temperature is known as the “Urban Heat Island” (UHI) effect.
- UHIs vary considerably depending on the size of the city, the amount of greenery, and how densely built up and well ventilated it is.
- Primarily caused by urbanization, pavements and roofs represent +60% of urban surface and are major contributors to UHI.
- Key mitigations measures: increase of green areas, A/C systems and design of cool surfaces.

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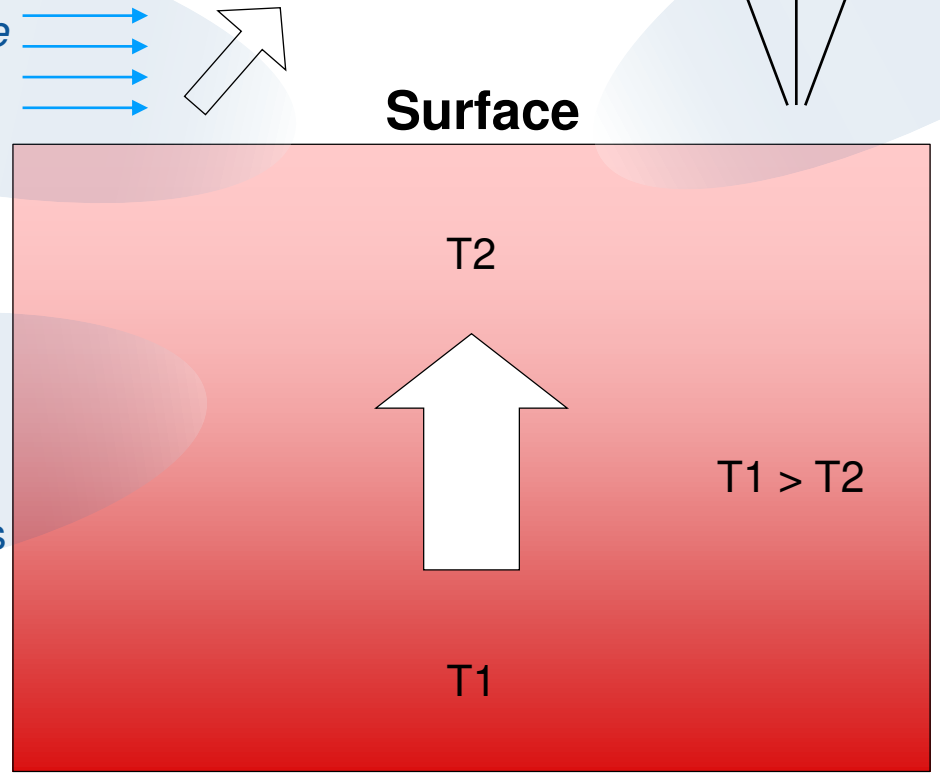
The Paradox of A/C: A Life-Saver That Aggravates Global Warming*

- Of the 2.8 billion people living in the hottest parts of the world, 10% has access to A/C, according to the International Energy Agency.
- In the coming decades, A/C manufacturers target growing markets in Asia and Africa. By 2050, over 65% of the world could have an A/C.
- Space cooling makes up nearly 40% of all expected growth in **energy demand (!)** between now and 2050 (and impact the global carbon emissions).

Modes of Heat Transfer

Convection due to *motion of a fluid over a surface*

Radiation due to *energy emitted* from a surface *as electromagnetic waves*



Conduction *through a solid or fluid (gas or liquid)* due to random motion of constituent, e.g., electrons, atoms, molecules

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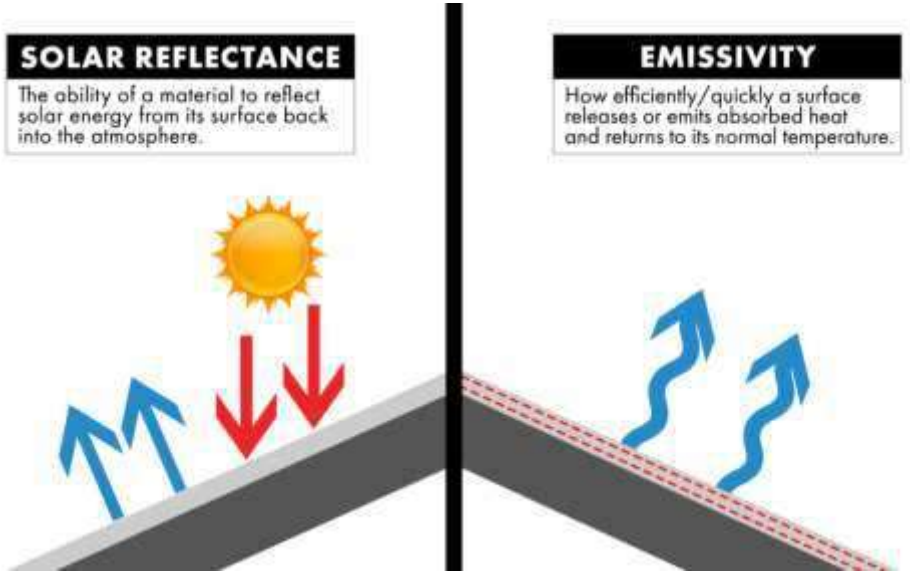
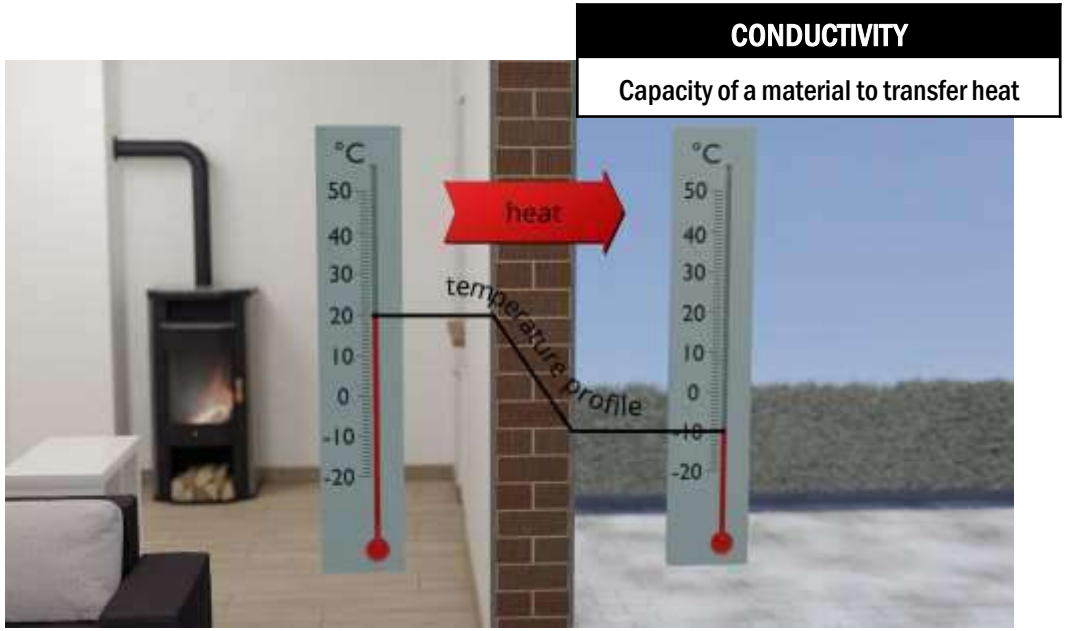
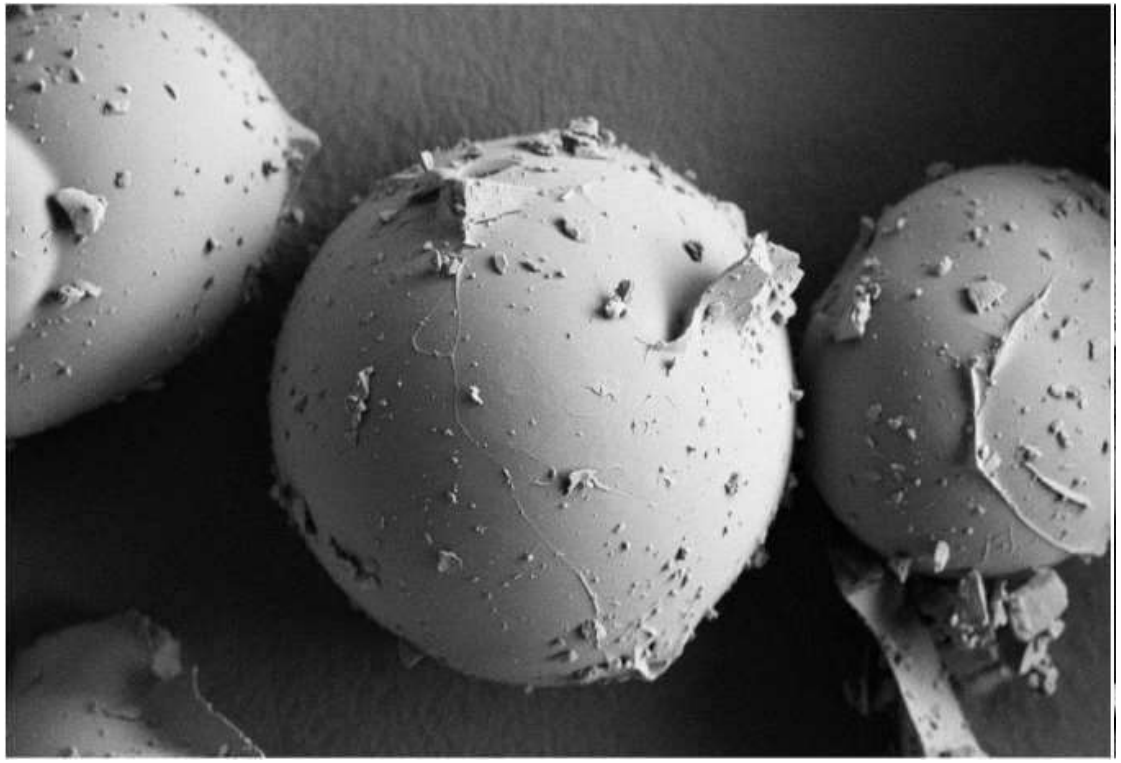
Reflectance, Emissivity, Conductivity …





Omyasphere Technology: Reduce Weight, Increase Yield and More



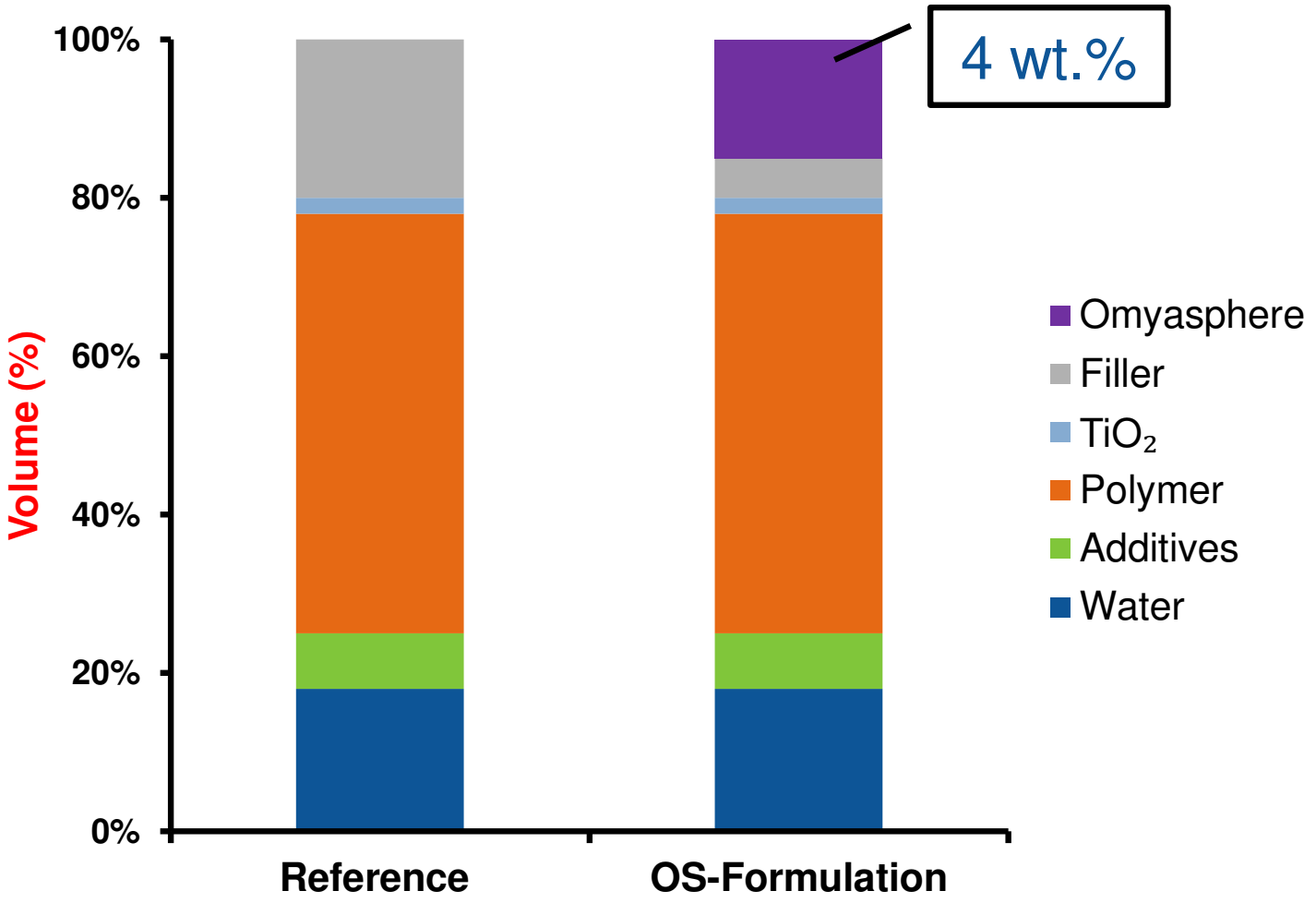
OS 212T: D50 of 40 µm, effective density of 0.3 g/cc, brightness (L*) of 90

Omyasphere® 200

Bulk Density (100 to 170 kg/m³)

Particle Density (0.25 to 0.40 g/cc)

Case Study No.1: A Solar Reflective Paint, Elastomeric Roof Coating



- Density evolution.
- Elongation at break.
- Emittance, reflectance and SRI.
- Thermal conductivity.

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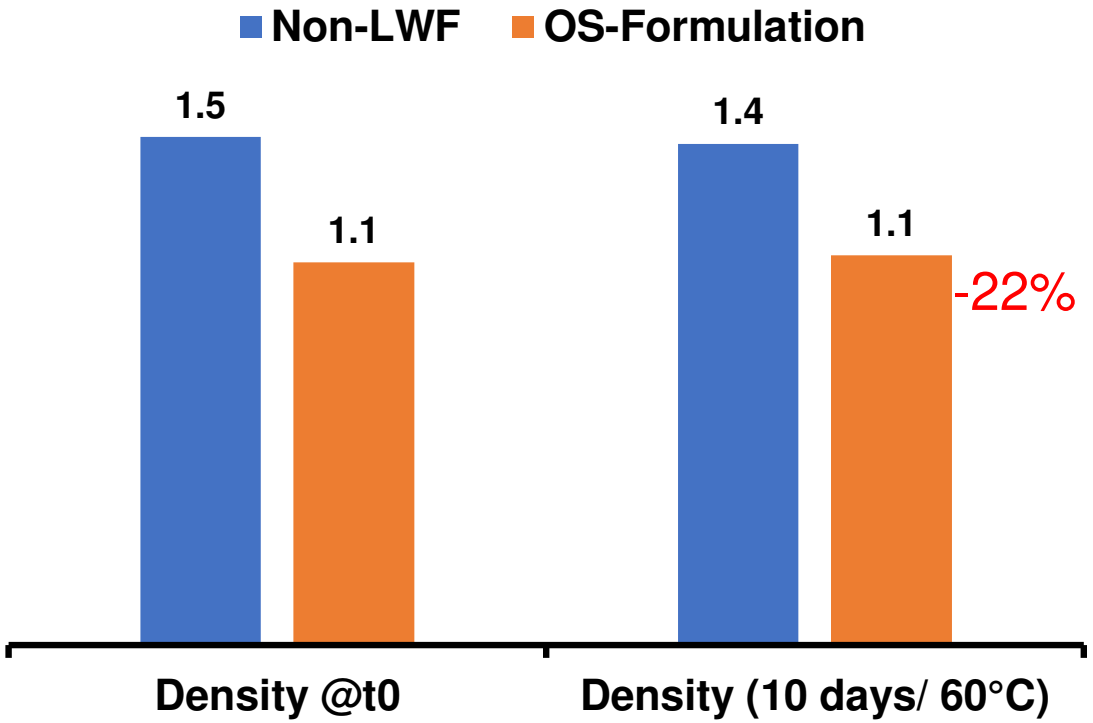
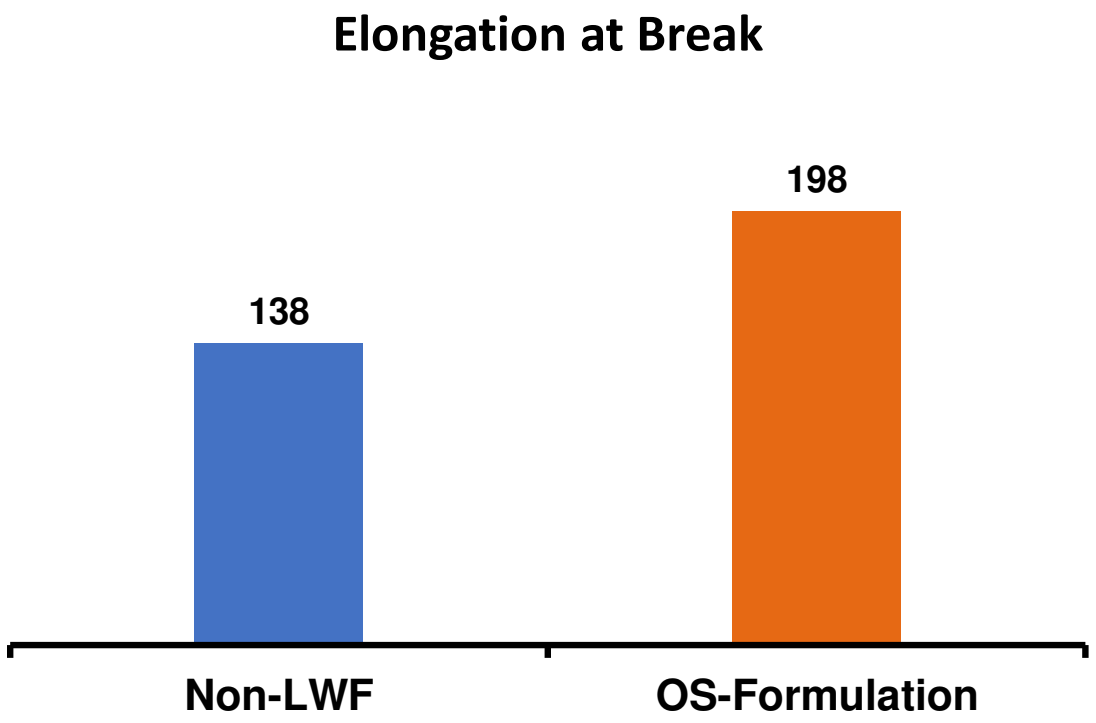
Case Study No.1: Impact on Density(g/cc) and Elongation at Break(dL%)



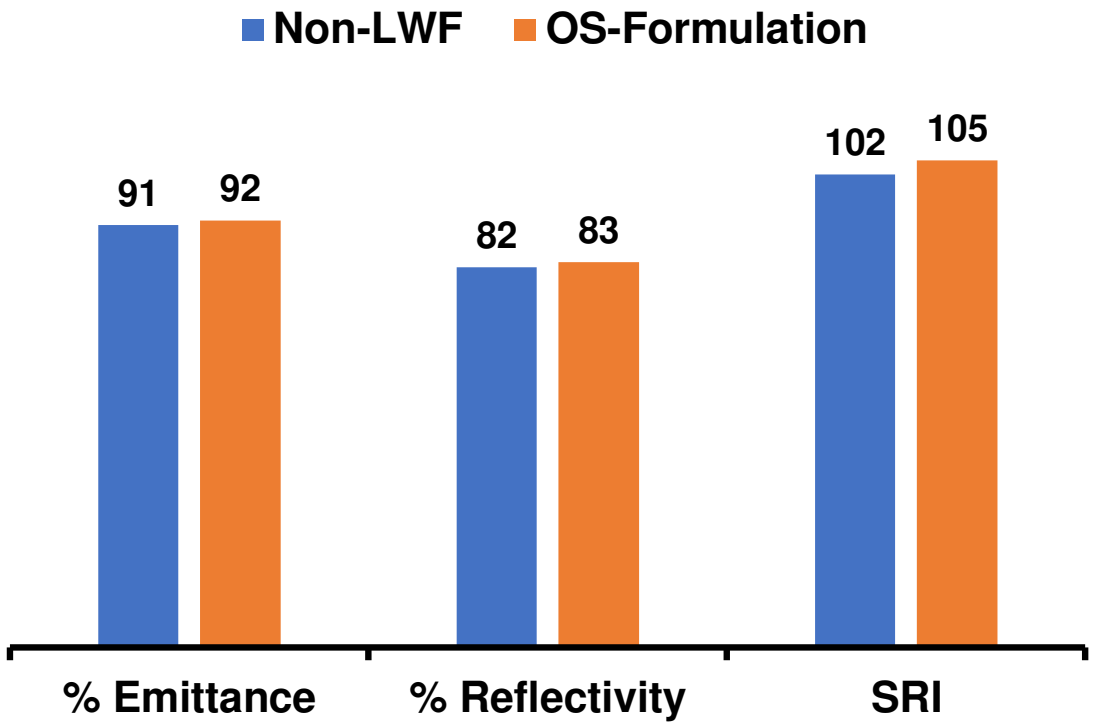


- Solar reflective paints and elastomeric roof coatings require high elongation. The latters' tolerance for movement is crucial because of the nature of a roofing substrate which expands and shrinks due to weather conditions and foundation settling.

- +30% elongation and flexibility improvement according to the test method (ASTM D2370/D624).

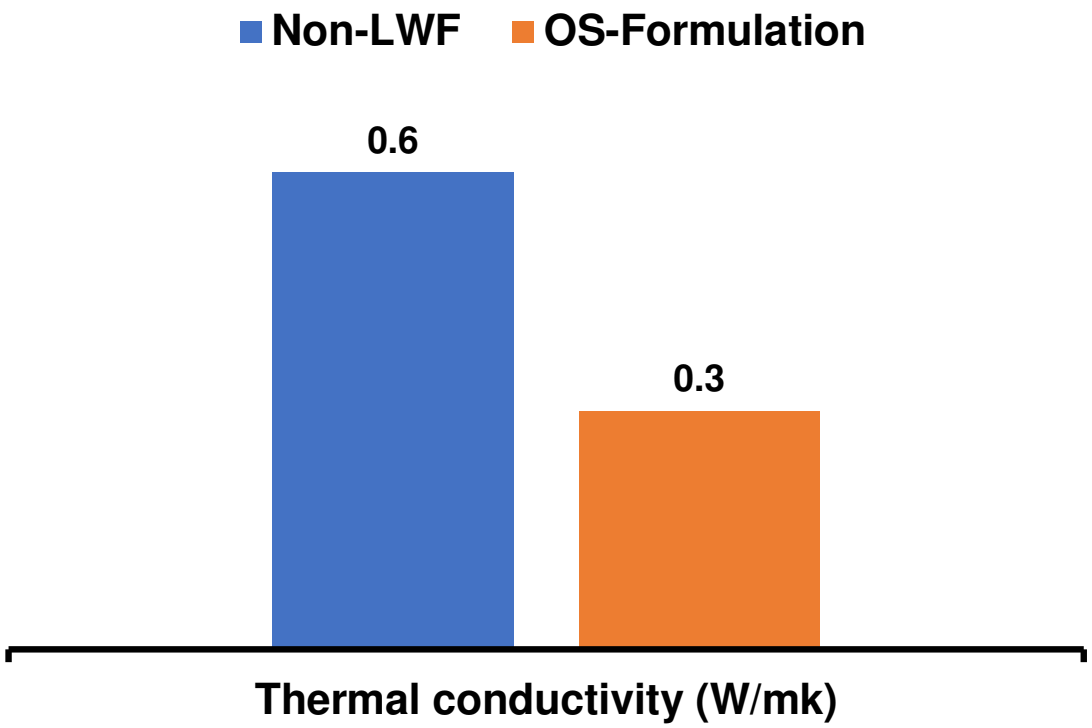
Case Study No.1: Solar Reflectance Index – SRI (ASTME903/E1980/E408)

- A coating's SRI is mainly influenced by the whiteness of the used mineral/pigment.
- A higher SRI suggests that a material reflects more sunlight and emits more thermal radiation, resulting in a lower surface temperature. *But …*
- **Due to natural weathering conditions, reflectance may be loss (fully or partially).**

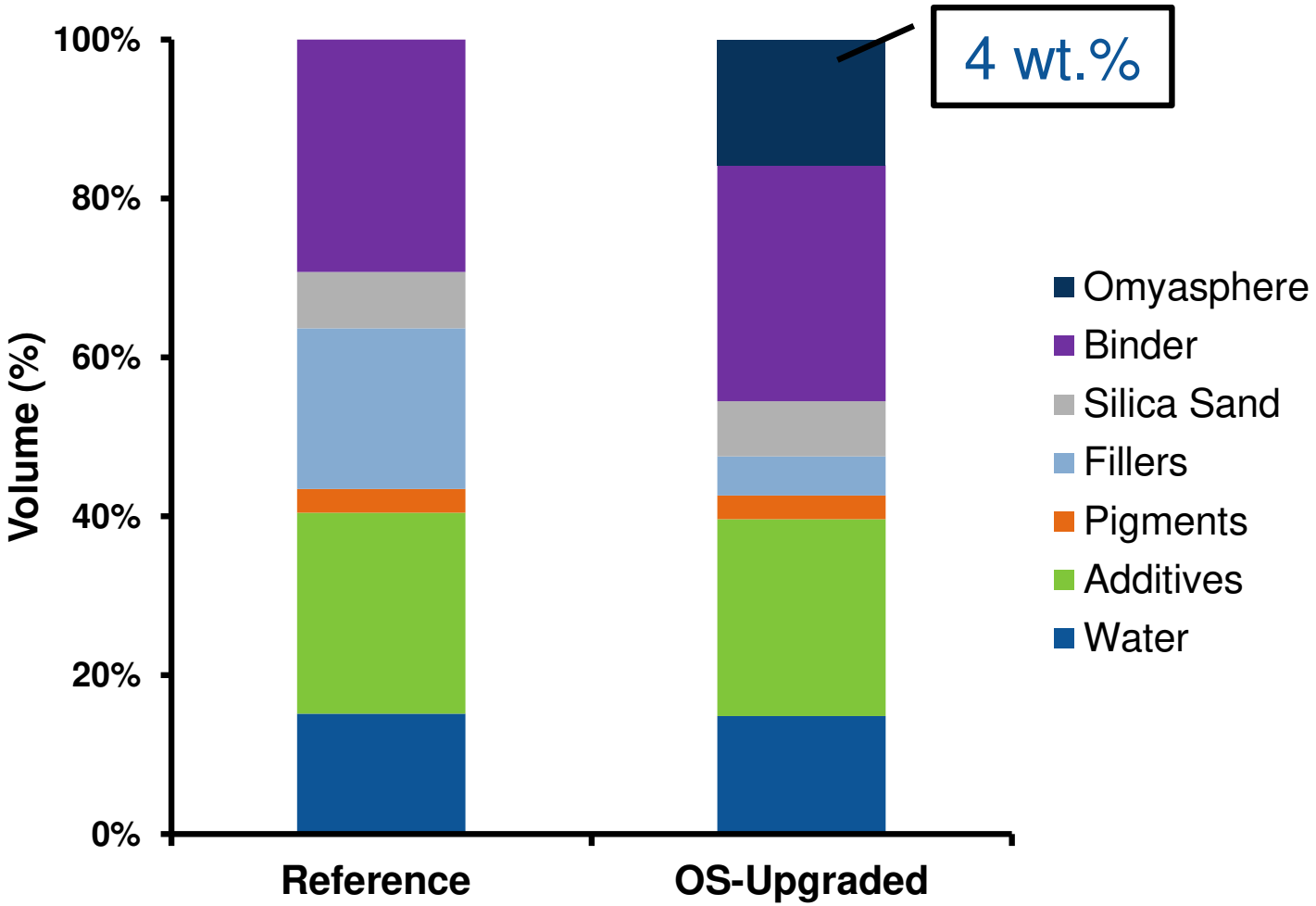


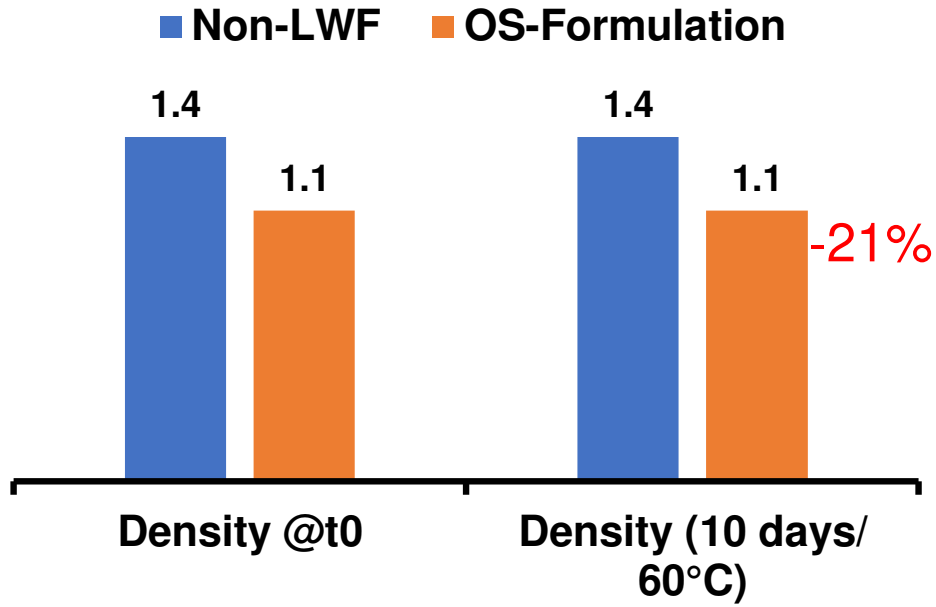
Case Study No.1: Thermal Conductivity/Insulation

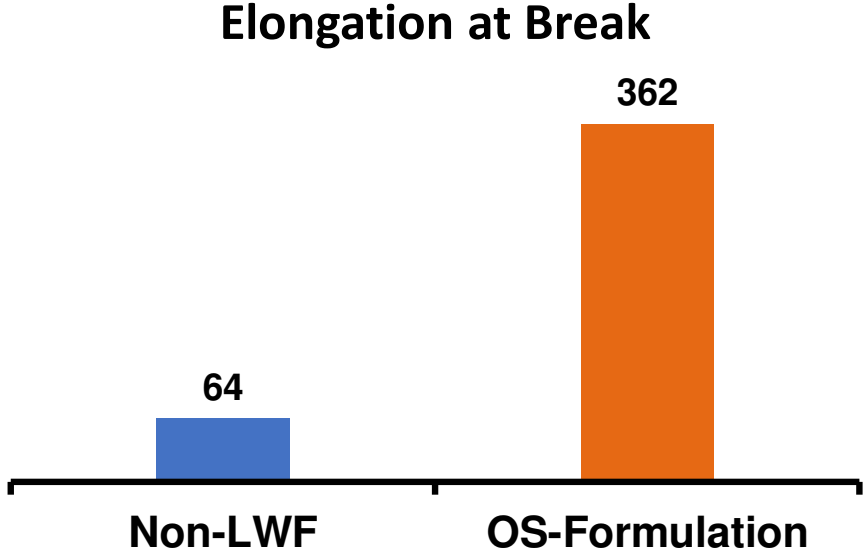
- The thermal conductivity of a material is the result of various heat transfer mechanisms dependent on e.g., the nature of the solids, thickness of the coating.
- Expanded perlite has one of the lowest thermal conductivity values among LWFs.
- Testing was carried according to ISO 2207-2:2008 (hot disk method).



Case Study No.2: Optimization and Impact on Yield/Elongation







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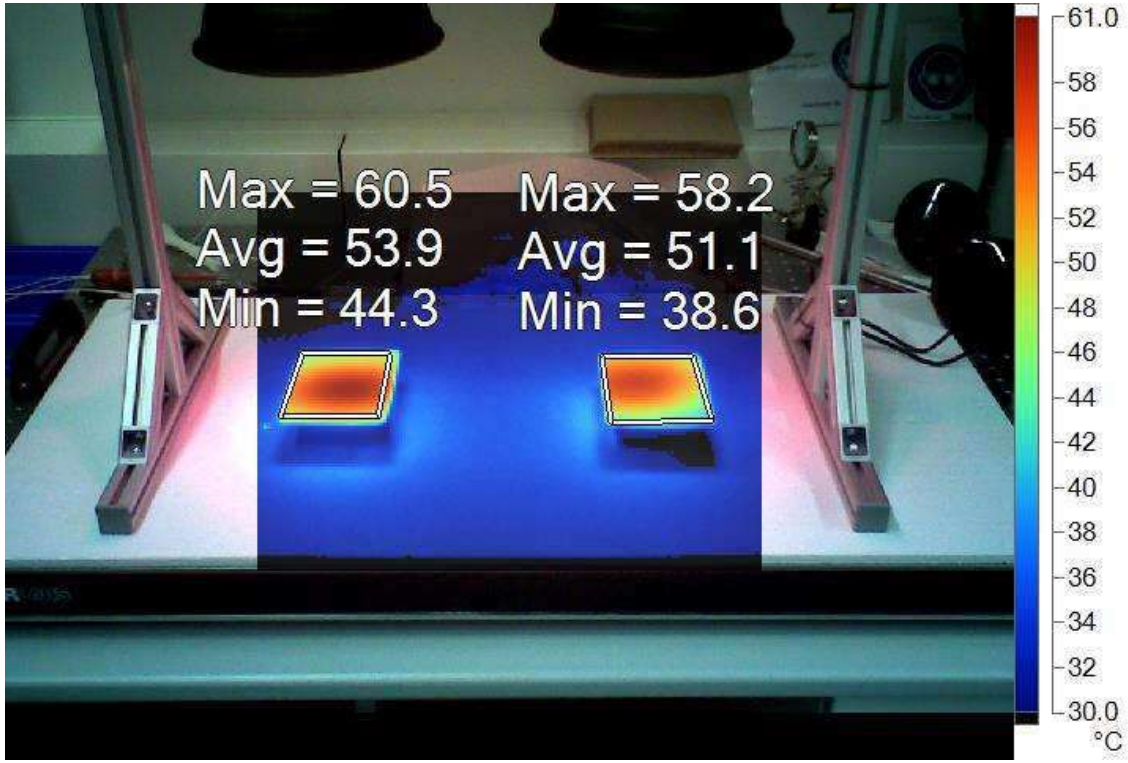
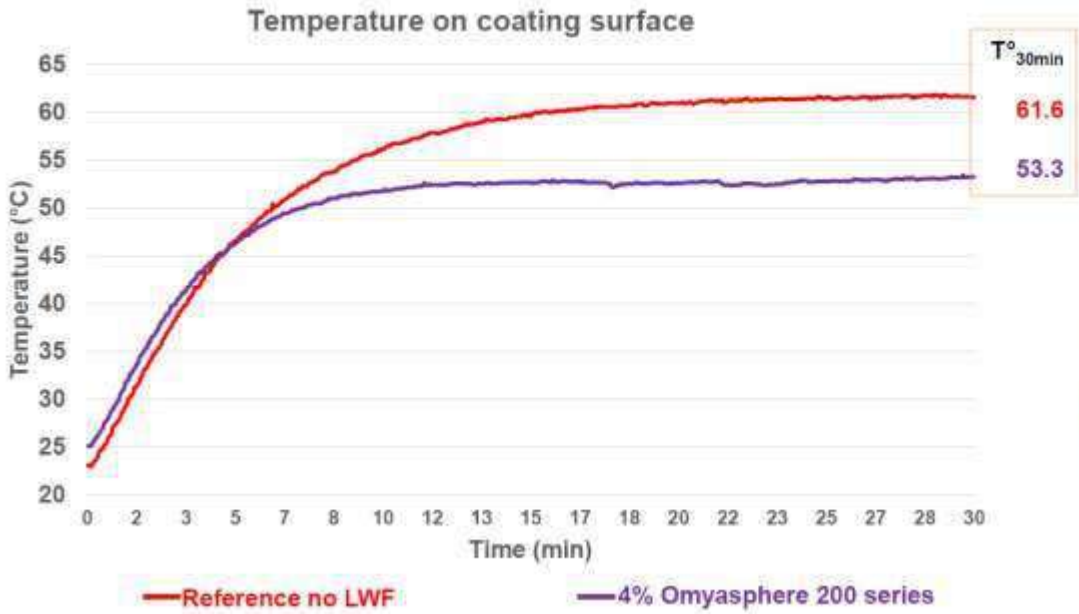
Case Study No.2: SRI and Thermal Conductivity

	SRI
Reference	108
OS-Upgraded	108
Difference	-



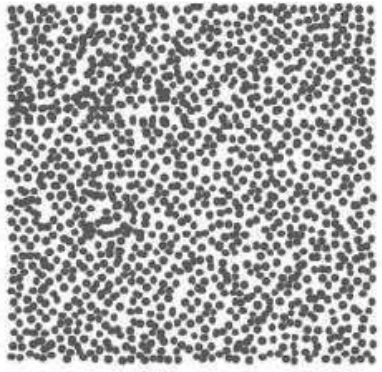
Case Study No.2: SRI and Thermal Conductivity

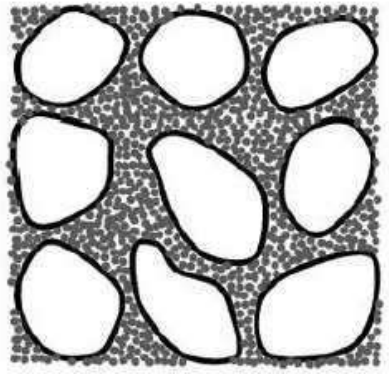
	SRI	Thermal Conductivity (W/mK)
Reference	108	0.91
OS-Upgraded	108	0.41
Difference	-	- 55%

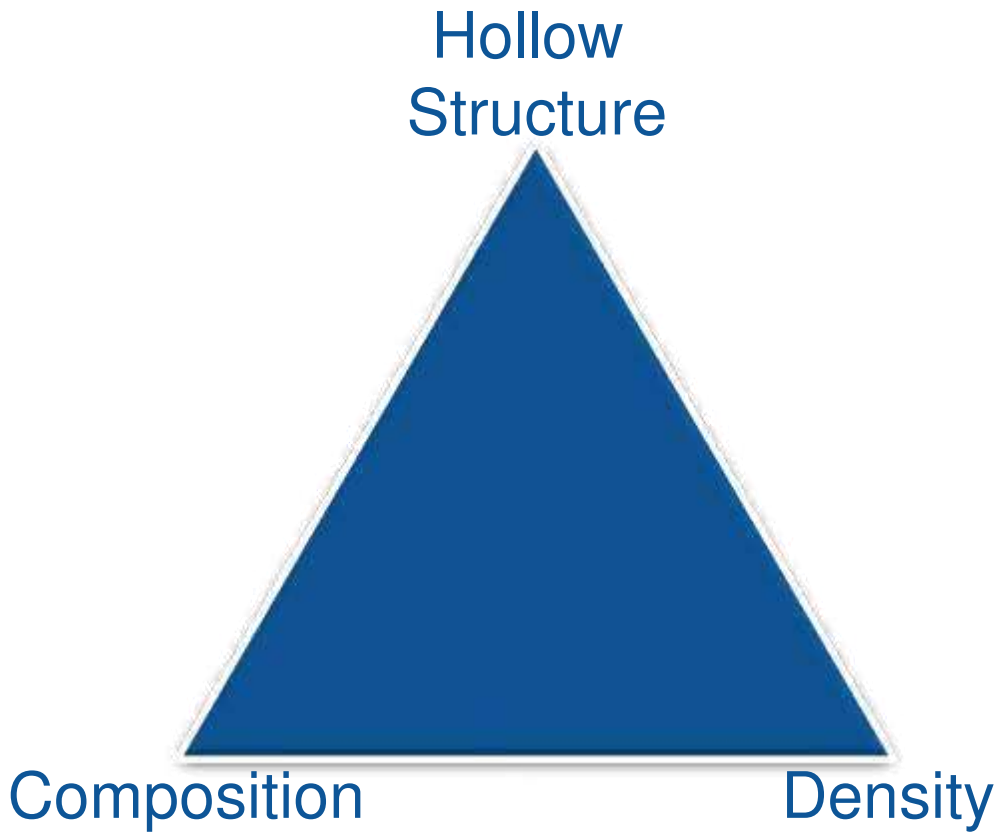


How OS Improves Elongation at Break and Thermal Insulation?

Omyasphere shape (sphericity) and low oil absorption require less binder, which yield a release of more free-binders; impacting positively on the elongation.







Key Takeaways

Upgrading a (P&C) formulation with Omyasphere yields:

- A density reduction of +20%.
- Higher yields at same weight (i.e., coverage) of +30%.
- Higher flexibility/elongation of +40%.
- Possibility of increasing its SRI (depending on the formulation).
- Decreasing its thermal conductivity (i.e., increase insulation) by +40%.

Addressing the challenges of global warming and/or UHI require a multifaceted approach, as there is no one-size-fits-all solution!

Our Global Figures

170
Locations

50
Countries

9’000
Employees

70
Nationalities

10
Innovation hubs

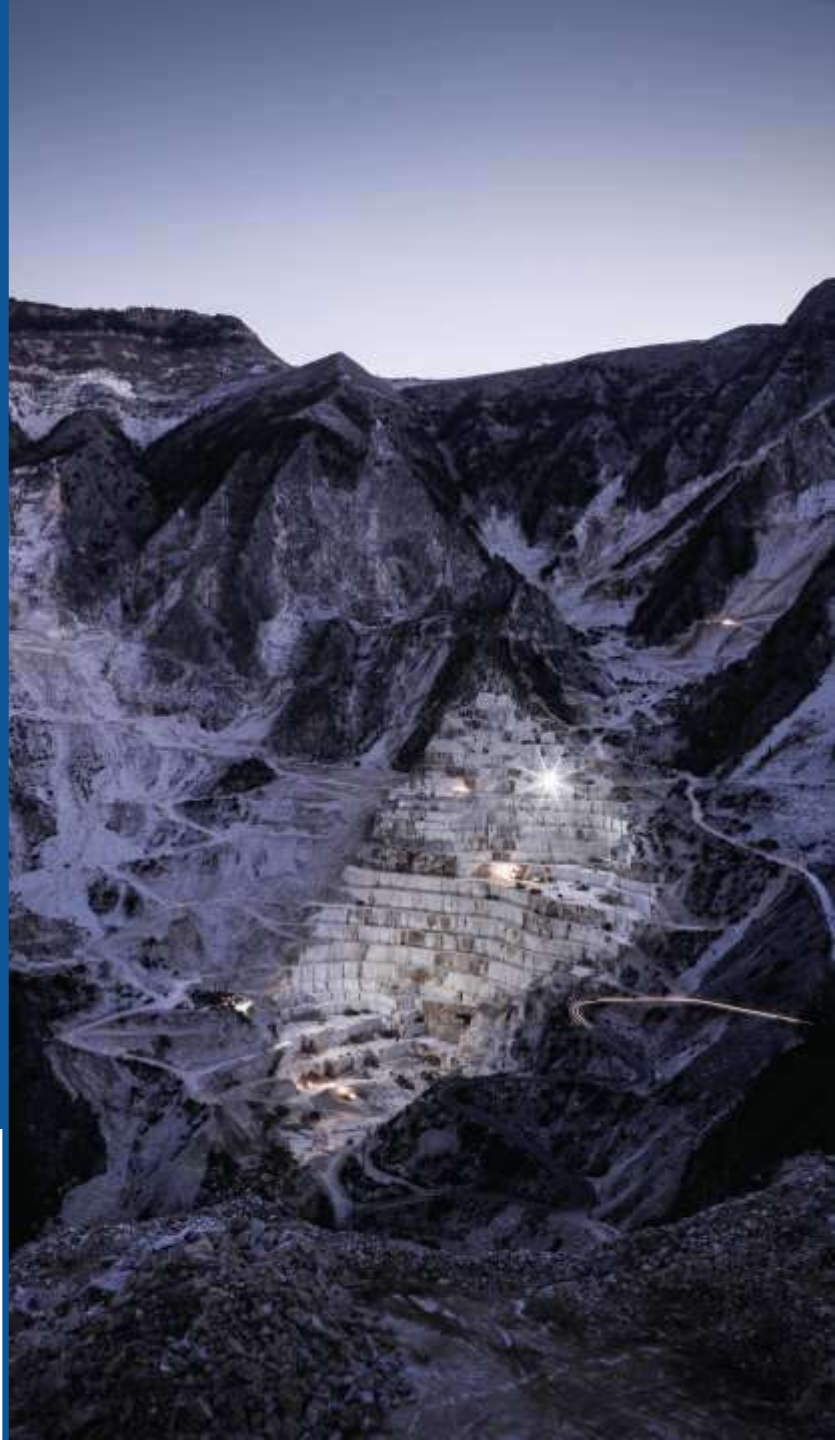
> 4
Billion turnover

Striving for Quality and Innovation

- Omya owns +300 patent families
- 75% of patents are considered innovative
- 47% of patents are related to the United Nations Sustainable Development Goals
- Omya is among the top 20 innovative companies in Switzerland

Source: PatentSight

Thank you.



THINKING OF TOMORROW

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