TALC: ECO² modifier for sustainable automotive TPOs

TPO Automotive Engineered Polyolefins conference

Sept 29th – Oct 1st, 2025.

Piergiovanni Ercoli Malacari - IMI Fabi Spa – Italy

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Outlook

- **TALC**: a natural functional mineral
- **ECO²** equation
- Solutions for automotive **TPOs**
- Improved **ECO²** solution
- Conclusions

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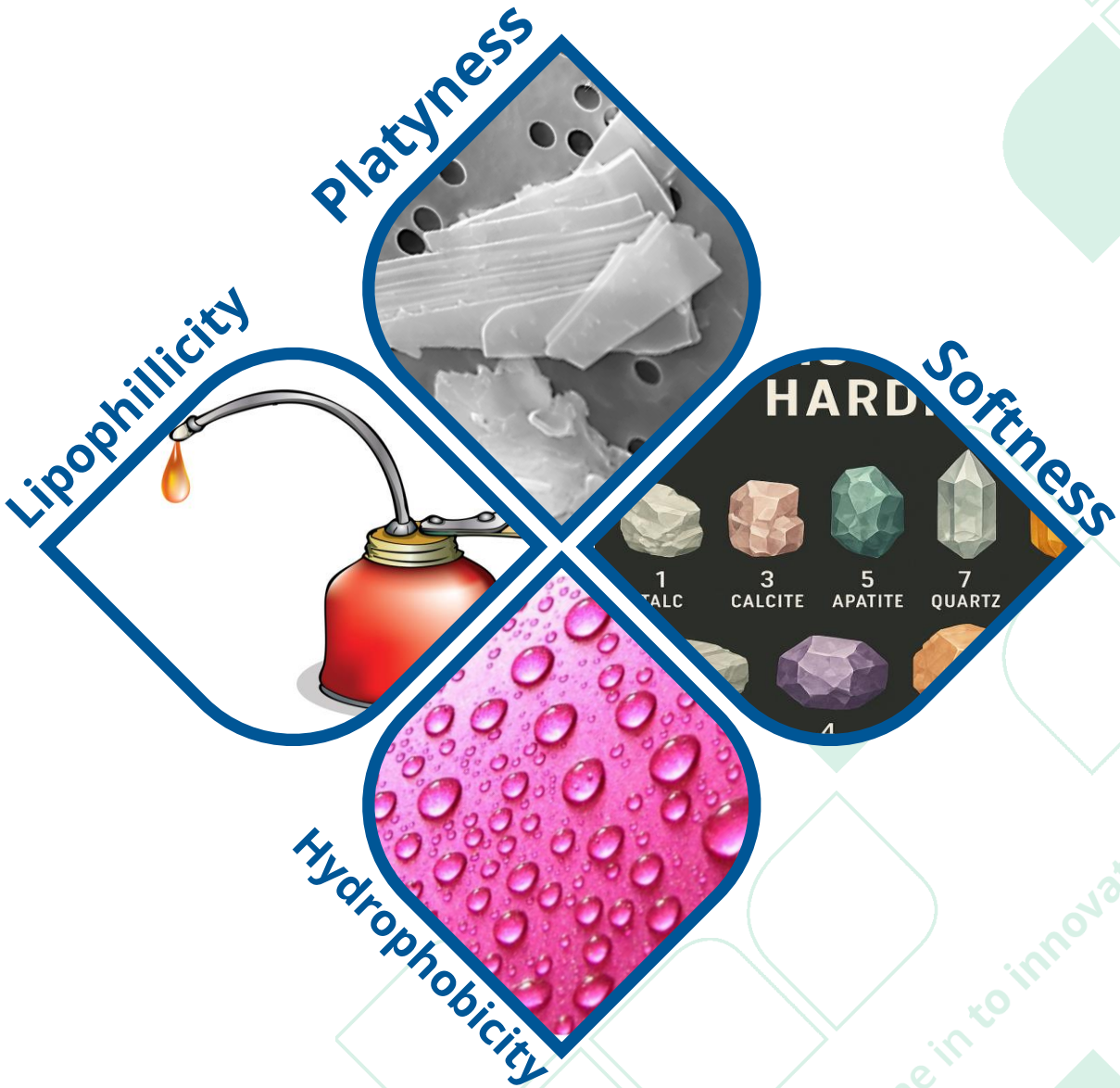
TALC: a natural functional mineral

Key properties of talc

Talc key properties

- Naturally occurring mineral
- Improves rigidity
- Affinity with chemicals
- No water absorption
- Minimal wearing

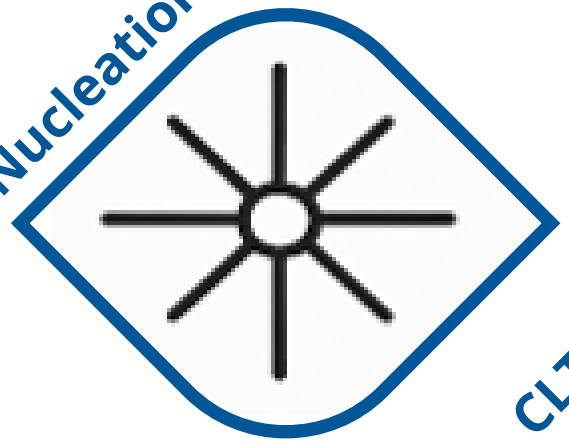


Talc enhances:

Rigidity

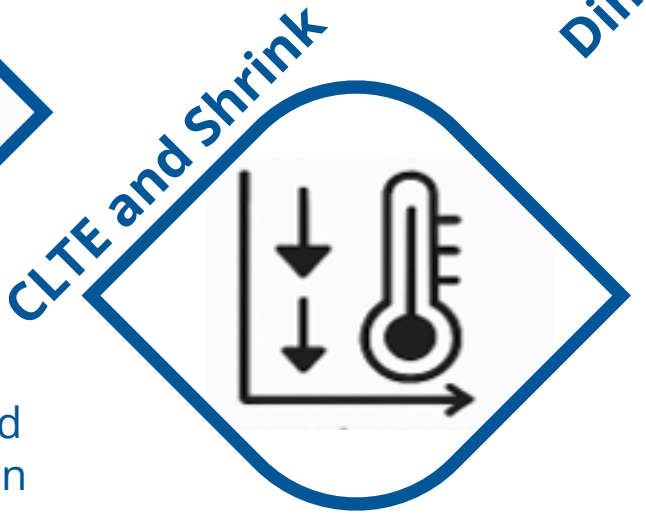
High talc aspect ratio visibly increases resin rigidity

Nucleation



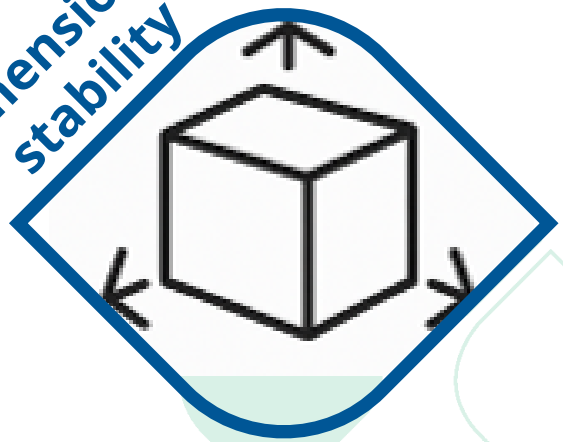
Lipophilic character and small particle dimension makes talc an effective nucleating agent

CLTE and Shrink



Aspect ratio combined with high particle orientation during shaping significantly reduce both CLTE and Shrinkage

Dimensional stability



Platy shape of talc determines similar shrinks in both MD and TD

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ECO^2 equation

ECO^2 equation

ECO =

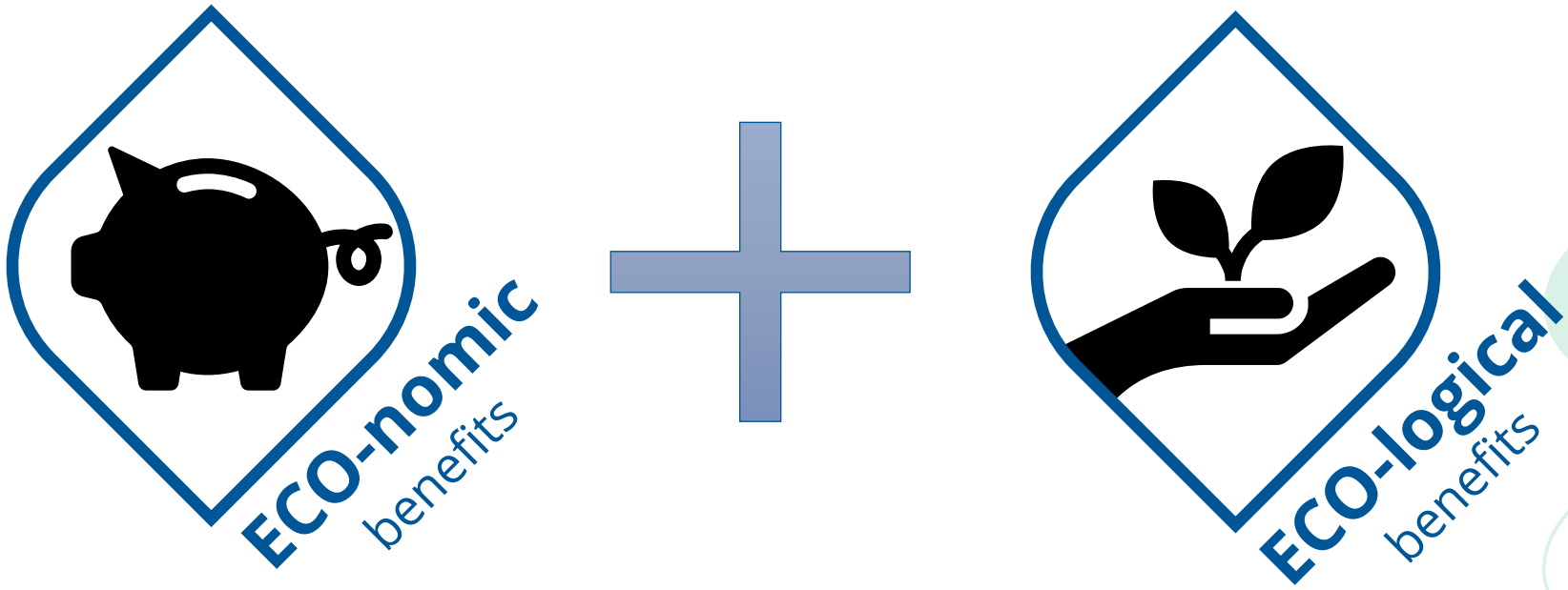
+

Economic

Ecologic

Double the value:

ECO^2 = ECO-nomic + ECO-logical performance



TALC allows cost savings and carbon footprint reduction versus neat resin with visible modification of mechanical properties

TDS Talc SM4.pdf

ECO-nomic benefits

Processing efficiency

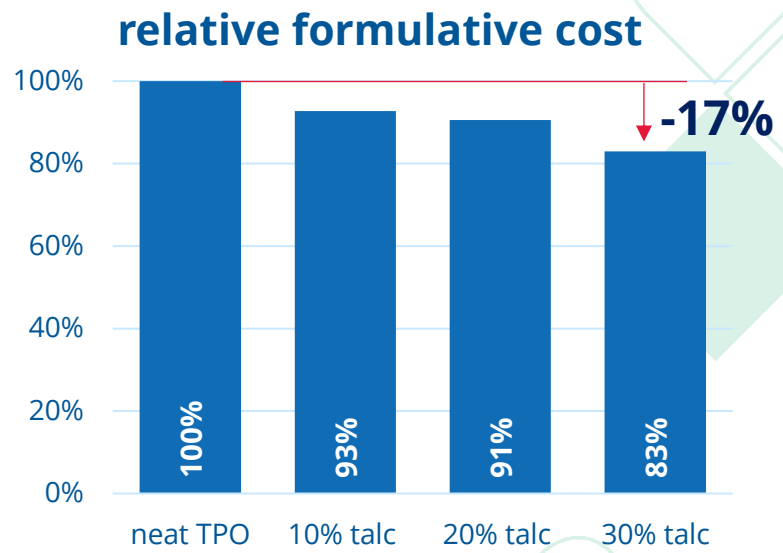
TALC optimizes molded part shrinkage leading to faster cycle times and lowers energy consumption during manufacturing

Lightweighting Downgauging

Talc reinforces TPOs enabling lightweight and downgauging solutions, helping automakers meeting fuel efficiency regulations

Cost Reduction

Talc helps reduce the use of costly polymers by acting as a filler, lowering material costs



Theoretical simulation based on formulation raw materials only – Calculation based on fine talc

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IMIFABI

ECO-logical benefits

Recyclability

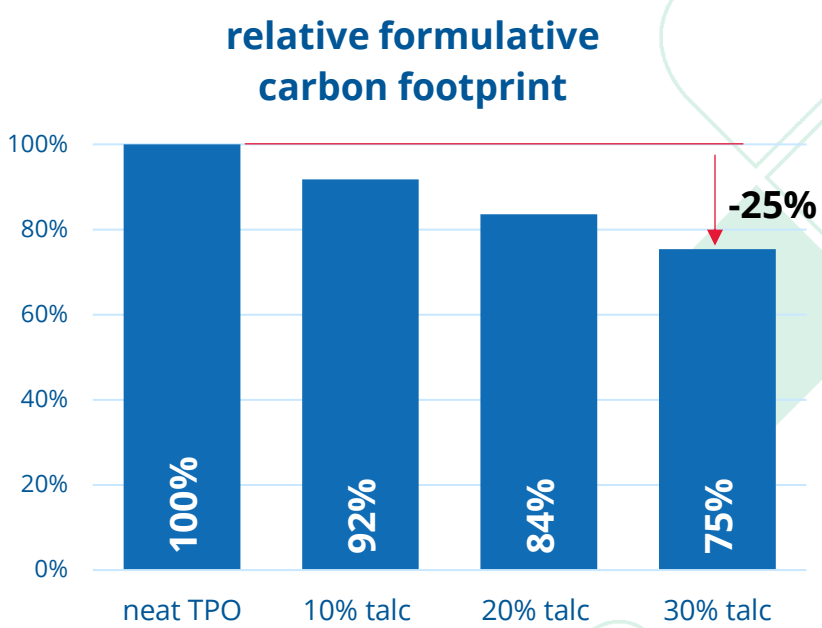
TALC enhanced TPOs are easy to recycle

Sustainable source

Natural occurring mineral with ethical mining practices

Carbon footprint

TALC based modifiers are normally lower in Carbon footprint than TPO



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Theoretical simulation based on formulation raw materials only – Calculation based on fine talc

Notes on Carbon Footprint

Resin

- Estimated indicative data from literature
- Additives were not considered

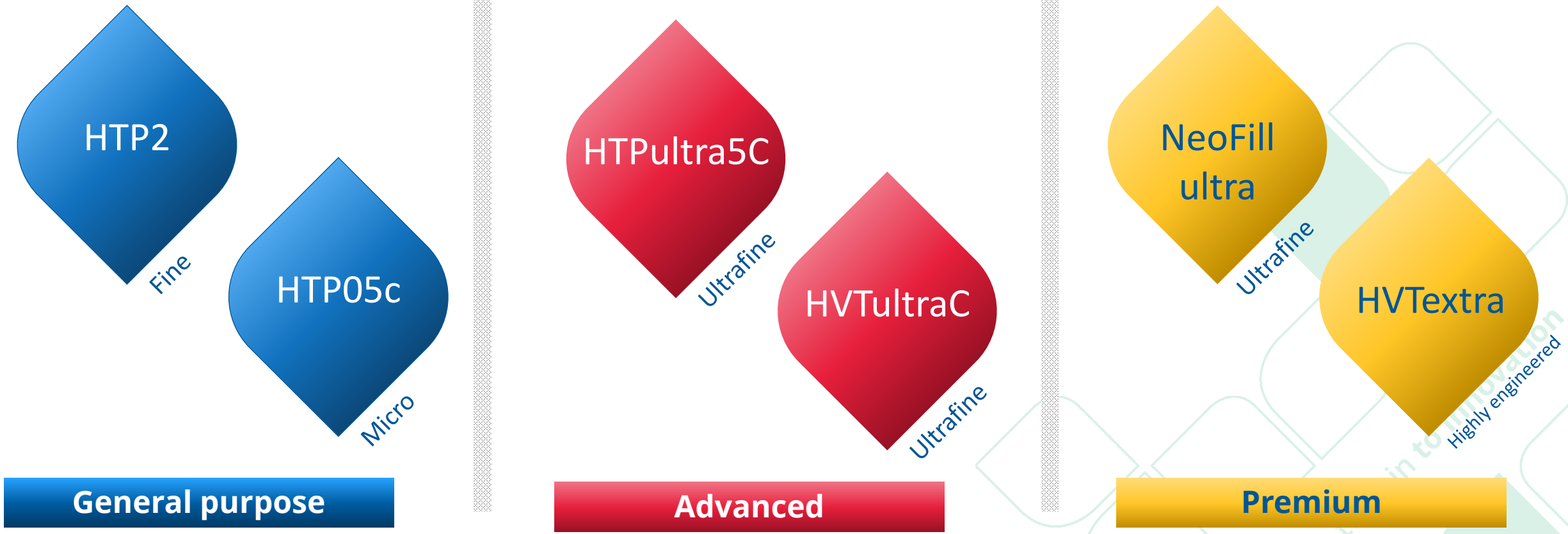
Talc

- Calculation according to ISO 14040 and ISO 14044
- Cradle-to-gate calculation (mining, transportation, processing and packaging)
- Ecoinvent 3.7 data used for LCA calculation

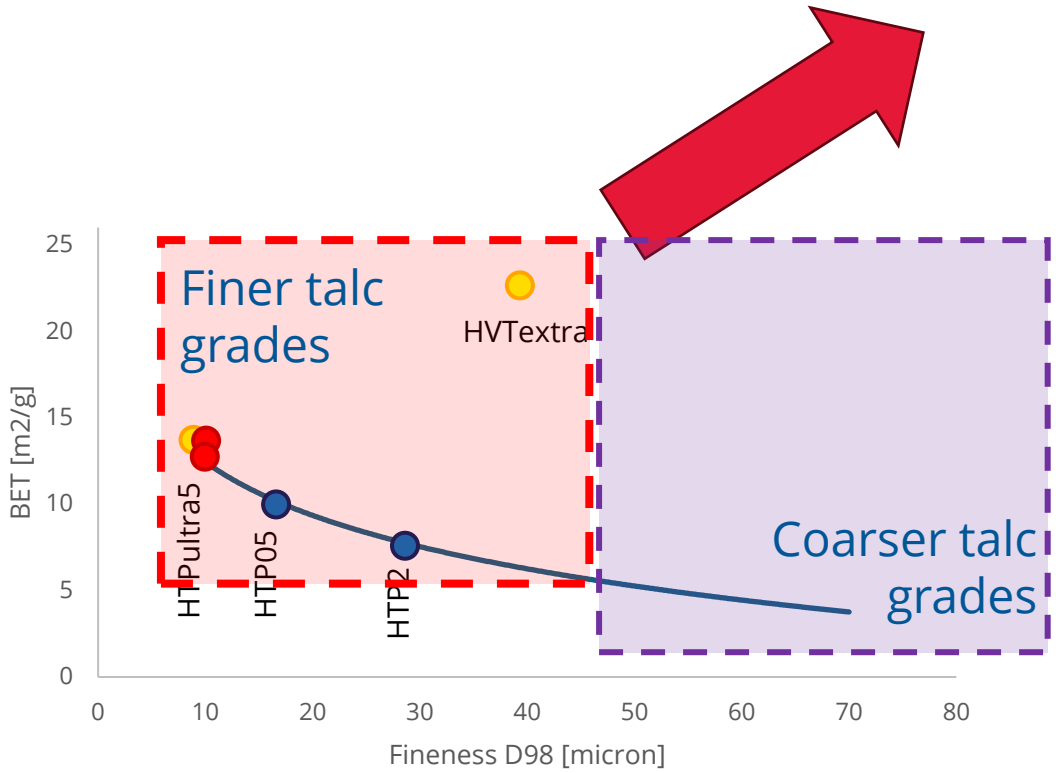
Solutions for automotive TPOs

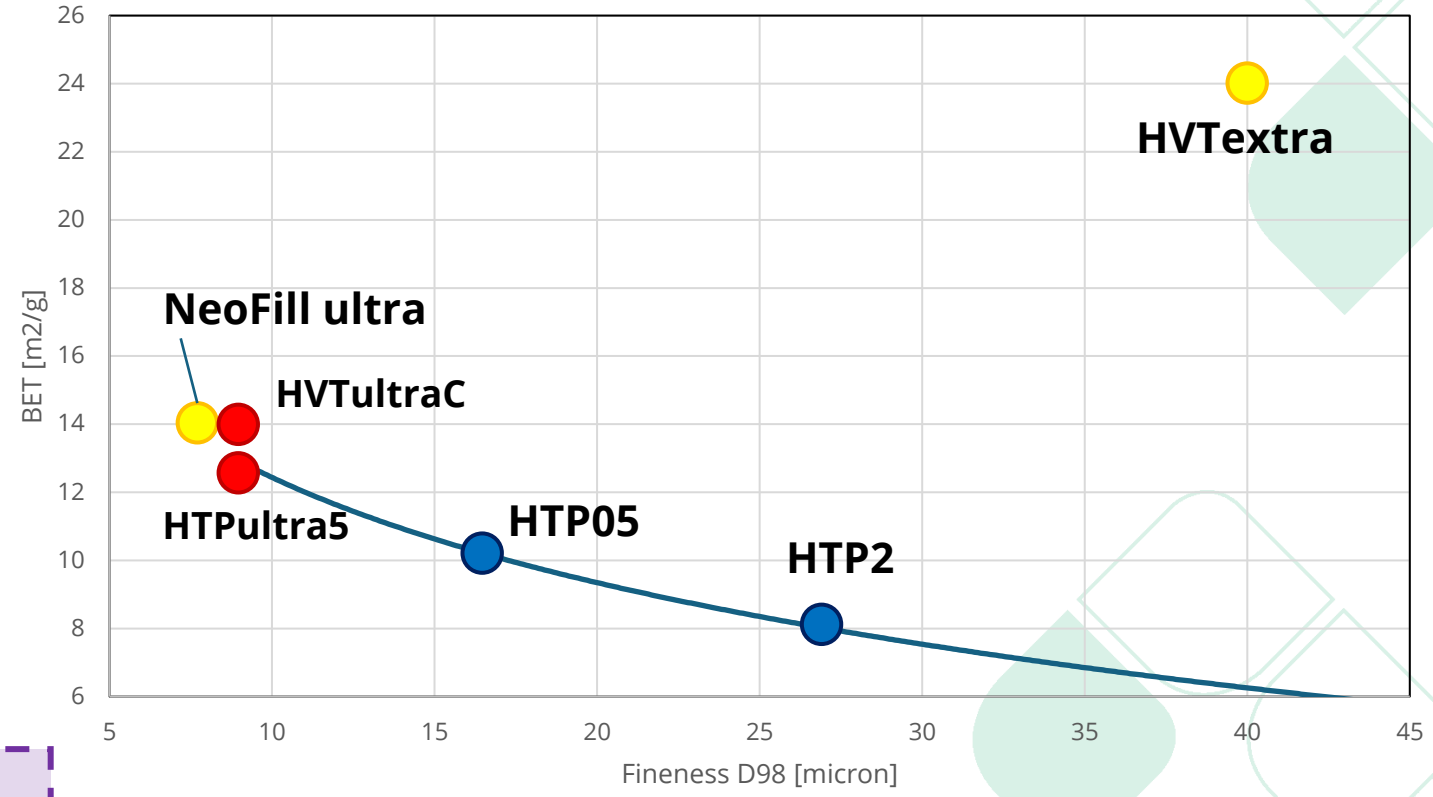
IMI FABI offers a wide range of products to fulfil the strictest requirements in Automotive TPOs

Example of TALC portfolio for Auto TPOs



Fineness Vs. Specific surface





General purpose

Advanced

Premium

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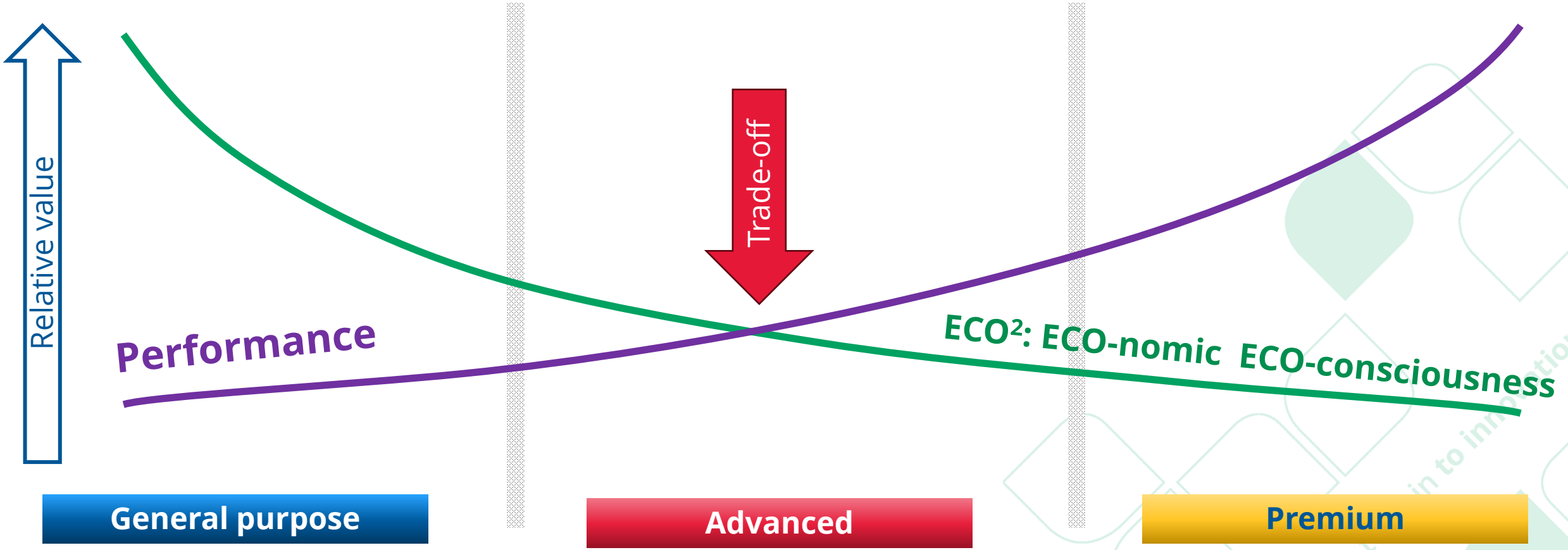
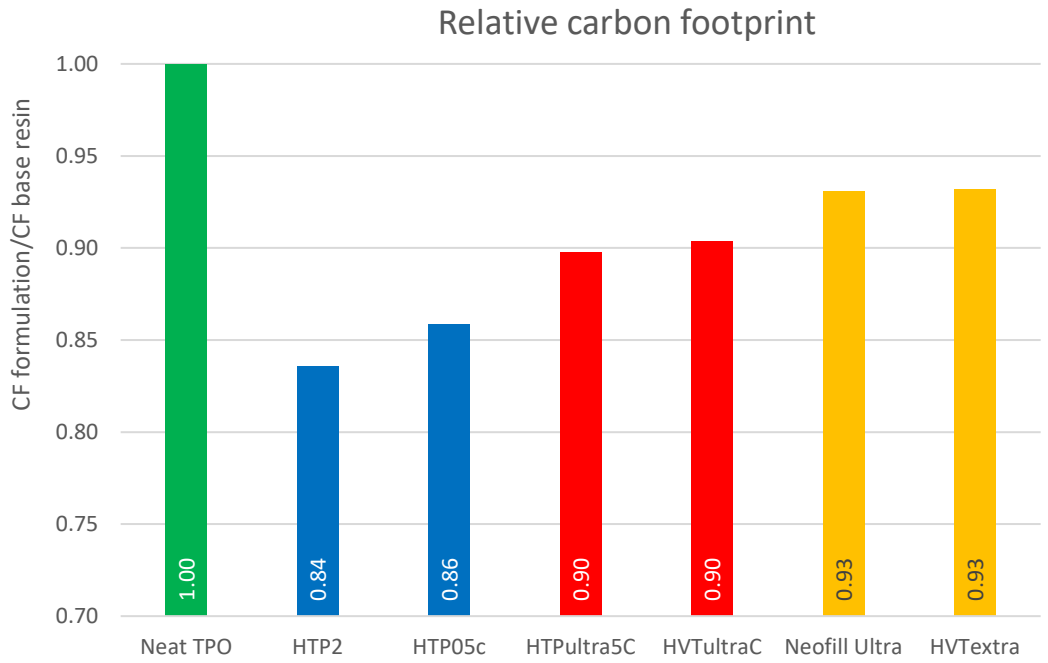
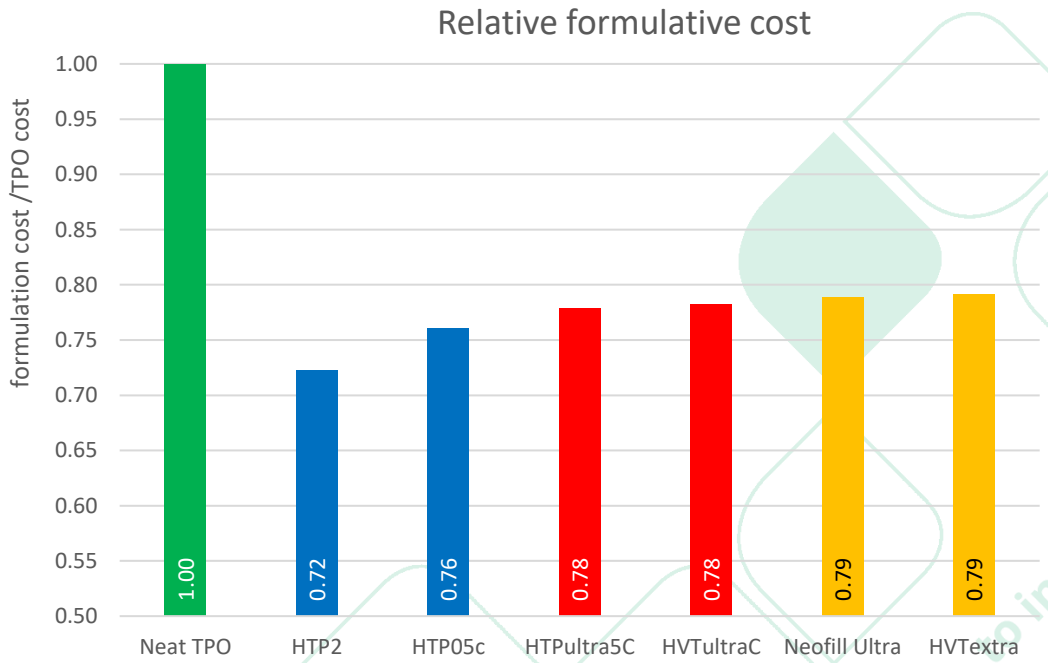
ECO^2 Vs. performance



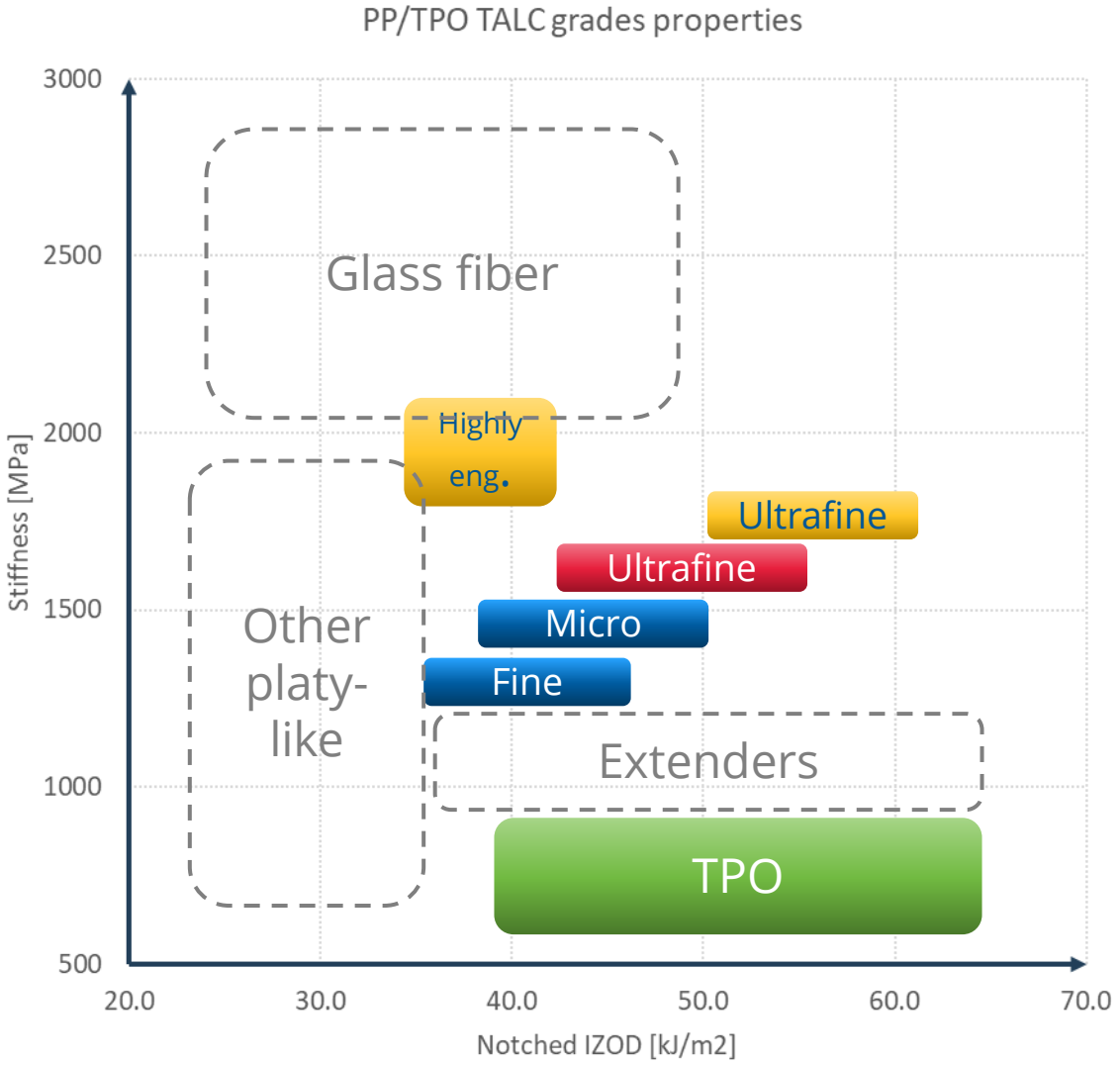
ECO² behaviour





Theoretical calculation based on components contribution only – for carbon footprint [kg CO2eq/kg material], a cradle-to-gate calculation is considered

TPO/PP talc grades properties



Examples of some typical applications

Fine

Micro

Ultrafine

Ultrafine

Highly engineered

Lightweighting

General data meant to explain relative performances

Experimental

- Test trials performed on a TPO (block copo PP + POE, total content POE= 21%) and modified with 20% talc
- Compounding performed by means of twin-screw co-rotating extruder, talc fed on molten polymer.
- Evaluated mechanical properties including CLTE, Shrink and Multiaxial impact
- Test performed according to both ISO and internal standards

Performances overview

PROPERTY	UNIT	Neat TPO	HTP2	HTP05c	HTPultra5C	HVTultraC	Neofill Ultra	HVTextra
Flexural modulus	MPa	773	1410	1550	1650	1710	1810	1955
Notched Impact Izod @ 23 °C	kJ/m^2	54	43	48	51	51	52	35
Notched Impact Izod @ -20 °C	kJ/m^2	53	15	21	29	31	35	16
Shrinkage	%	1.14	0.66	0.63	0.60	0.59	0.57	0.53
CLTE	µm/(m*K)	140	70	60	55	55	50	45
H.D.T.@ 1820 kPa	°C	45	51	53	55	55	56	58
Multiaxial Impact @-30°C	Failure type (*)	3.0	0.5	1.0	2.5	2.5	3.0	1.0

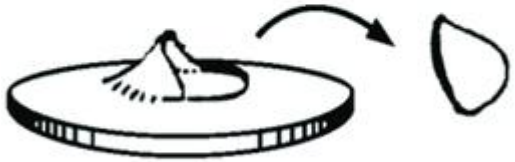
20% talc filled TPO (block copo PP + POE)

(*): 0-fragile; 1-fragile/ductile; 2-ductile with cease; 3 ductile

Multiaxial impact

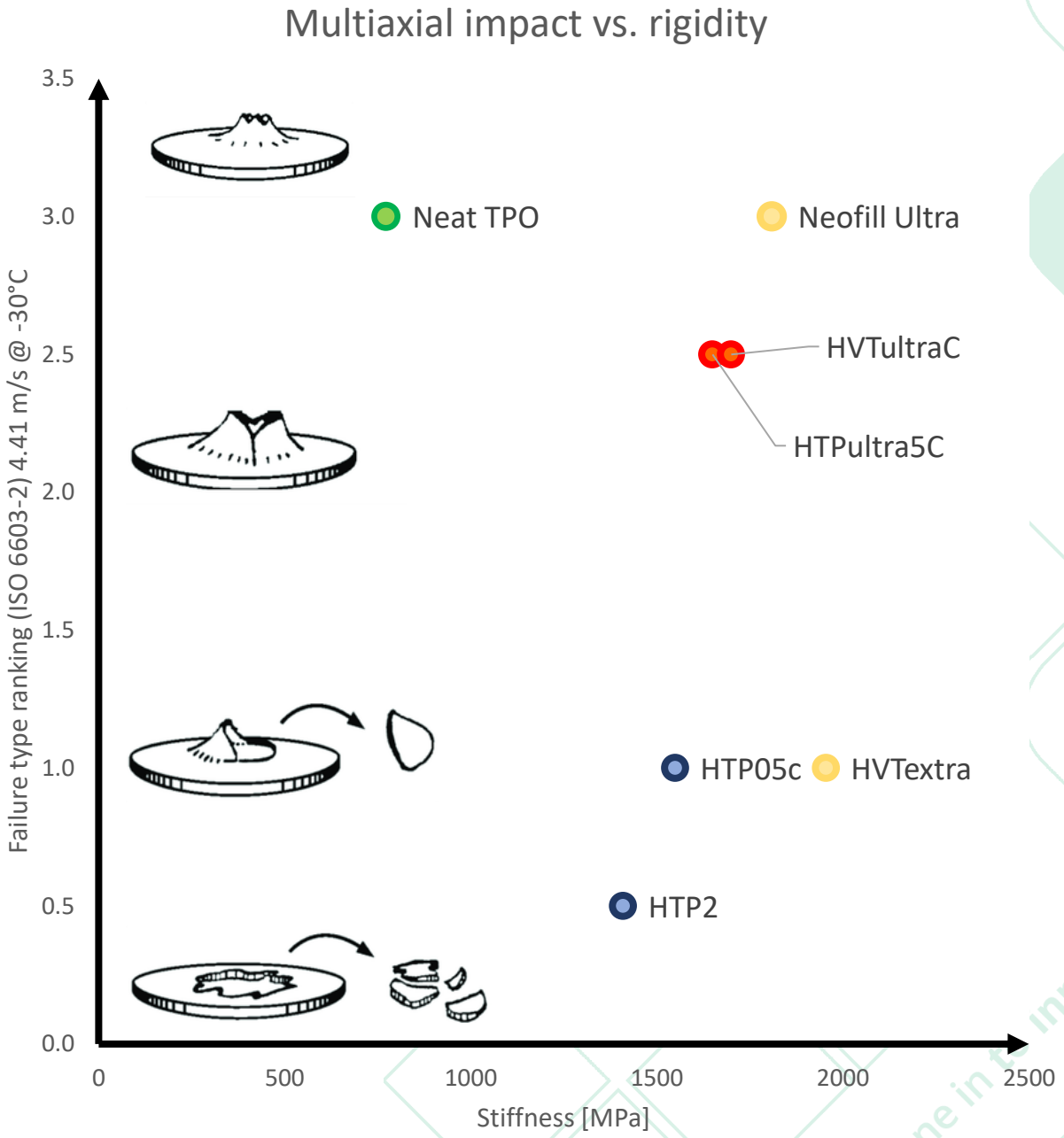
3 - Ductile

2 – Ductile with cease



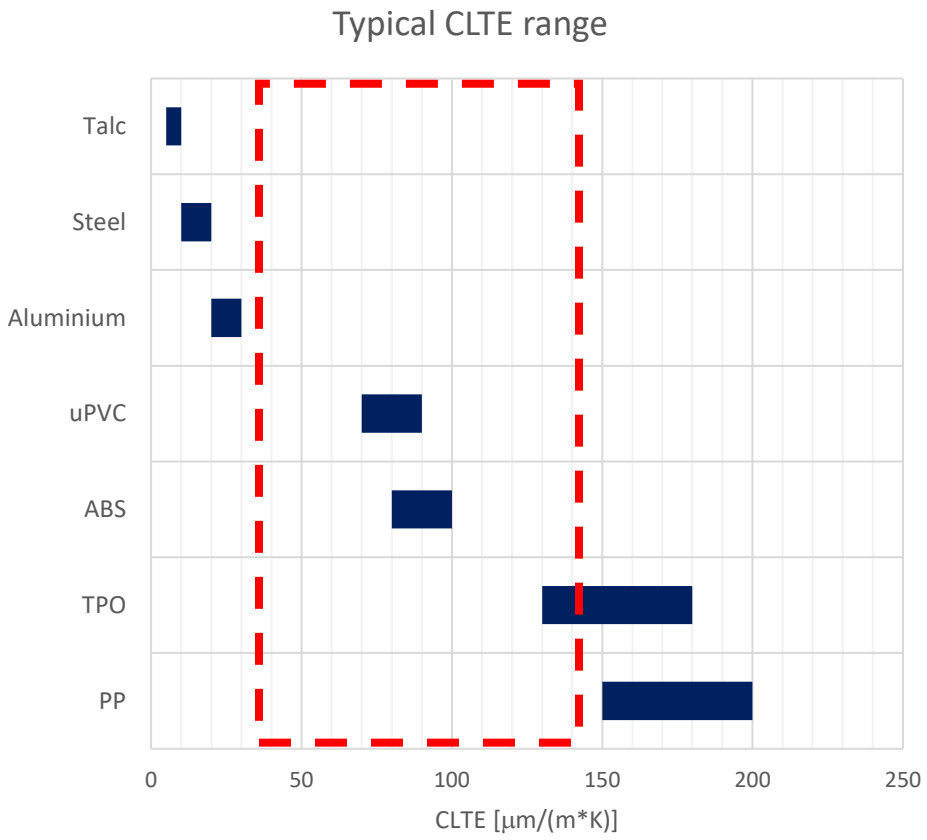
1- Fragile/ductile

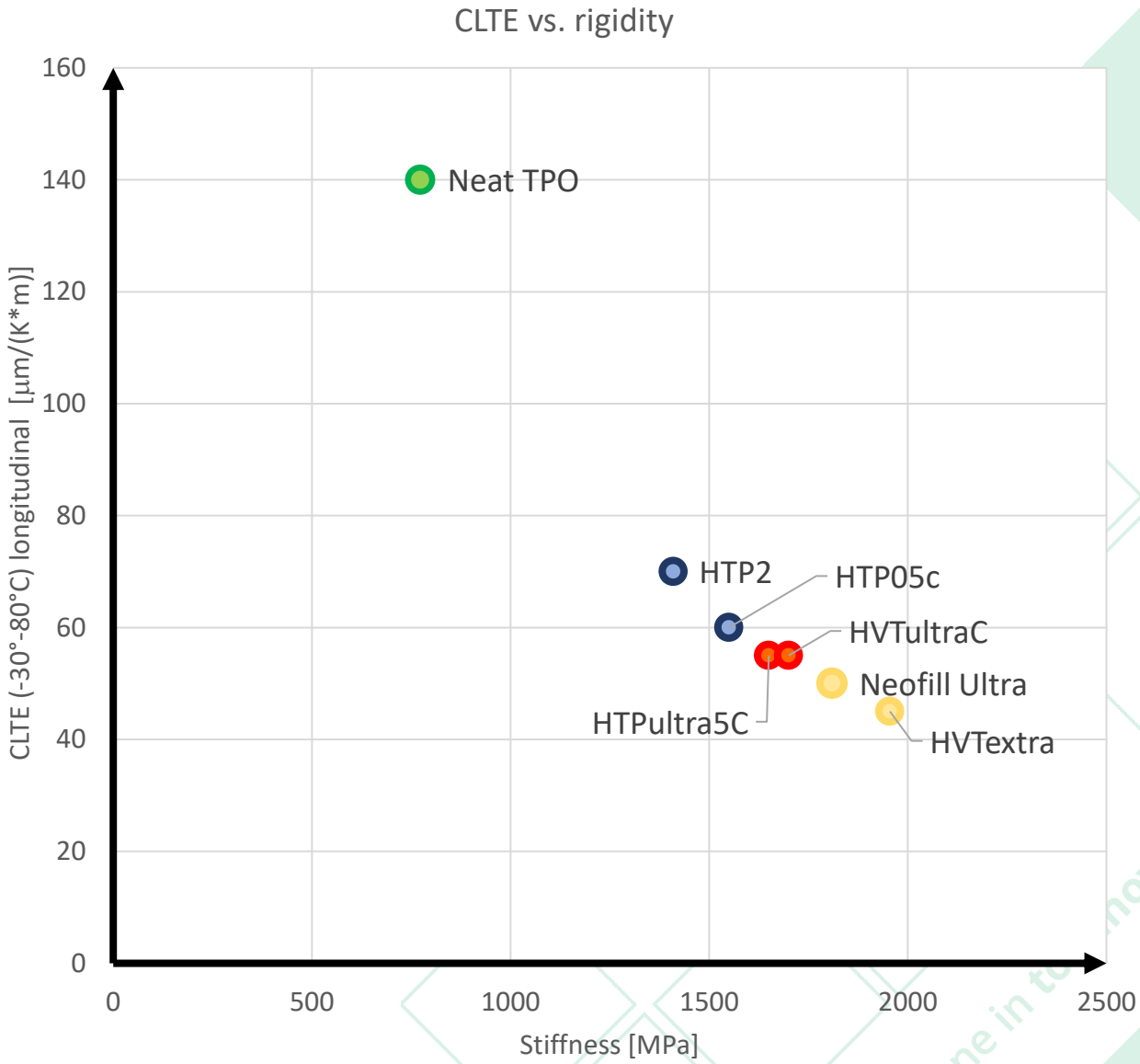
0 - Fragile



20% talc filled TPO (block copo PP + POE)

CLTE





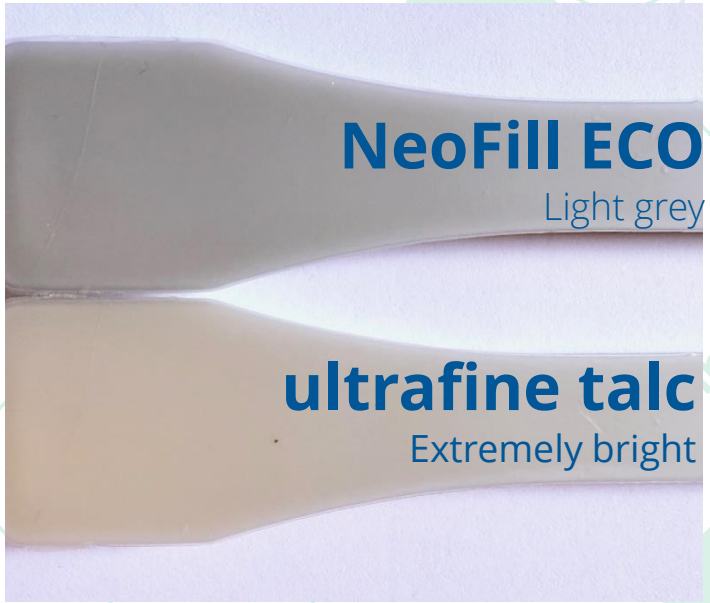
20% talc filled TPO (block copo PP + POE)

Improved ECO² Solution

Innovative sustainable materials transforming automotive industry

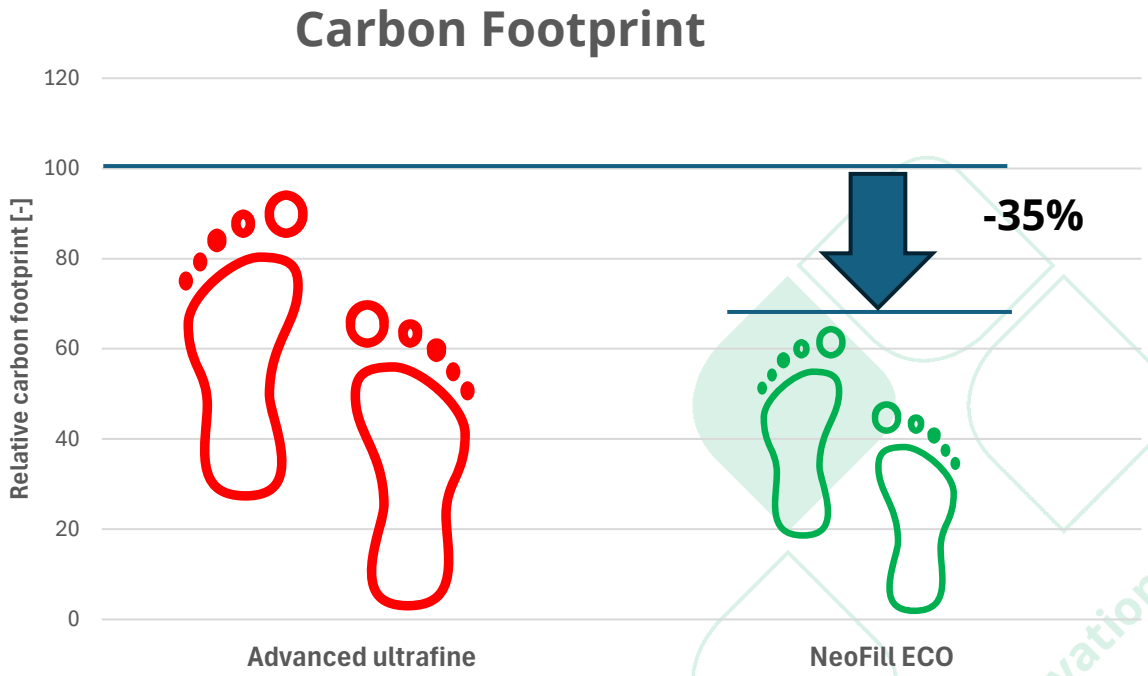
NeoFill ECO

- Performances as good as an advanced (extremely bright) ultrafine talc
- Perfect for color insensitive applications



NeoFill ECO

Thanks to process optimization and raw material selection, **NeoFill ECO** offers a reduced carbon footprint versus an advanced ultrafine talc, achieving same set of performances



cradle-to-gate calculation is considered for relative Carbon footprint [(kg CO2eq/kg material)/(kg CO2eq/kg material)]

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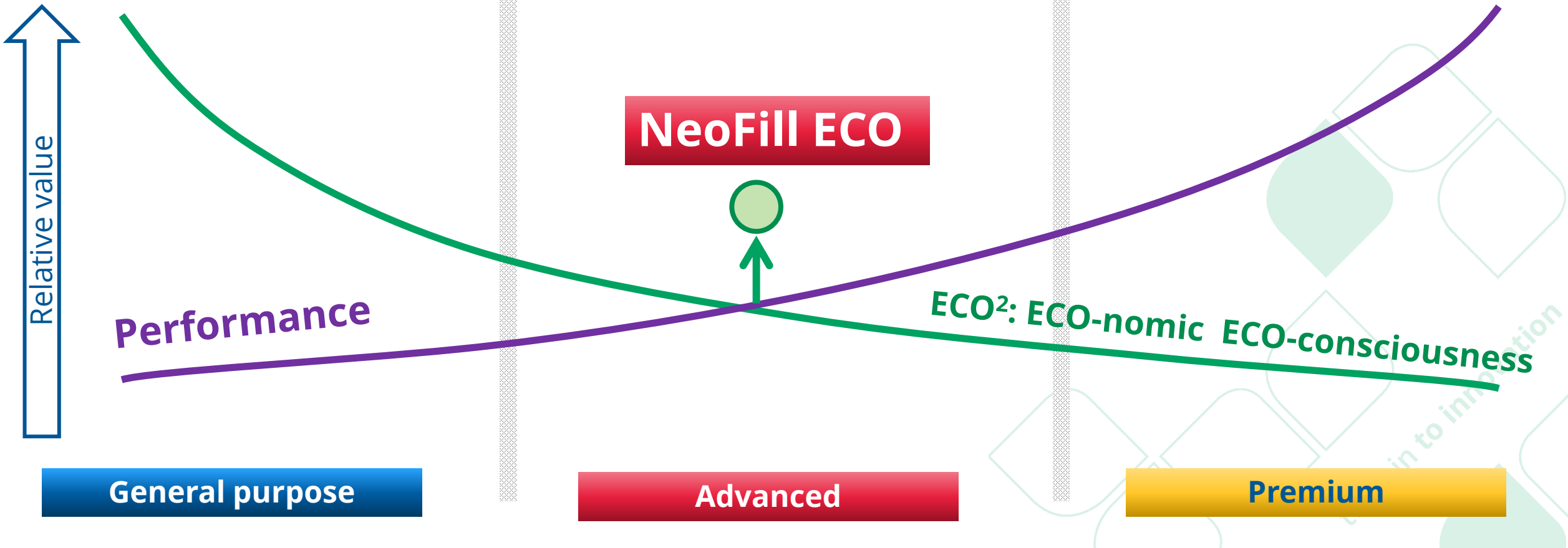
NeoFill ECO shows Improved ECO² properties per same class of mechanical performances

Neofill ECO: ECO² Vs. Performance



Take home messages

Conclusions

Take home messages

- **TALC** is a natural mineral modifier, perfect for **TPOs**
- **TALC** is a functional additive capable to boost **ECO²** properties
- **NeoFill ECO** even more improves **ECO²** properties

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