



Developing a Sustainable Powder Coating Formulation

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Coatings Trends and Technology

September 7, 2023



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**FAMILIAR
BONDS**



**COMPOUND
KNOWLEDGE**



**MICRO
MATTERS**



**BEYOND
DURABLE**



**CHALLENGE
TESTED**



Birla Carbon is Part of the Aditya Birla Group



TECHNOLOGY

130+ state-of-the-art manufacturing facilities.



FISCAL STRENGTH

US \$60 Billion Corporation –
Over 50% Revenue from international operations.



INFRASTRUCTURE

Present in 36 countries across 6 continents.



DIVERSE TALENT

140,000+ employees representing 42 nationalities.



GROUP WITH A PURPOSE

- Sustainability
- Responsibility for our communities
- Customer Centric

- ✓ ACRYLIC FIBERS
- ✓ AGRI-BUSINESS
- ✓ CARBON BLACK
- ✓ CEMENT
- ✓ CHEMICALS
- ✓ FINANCIAL SVCS.
- ✓ INSULATORS
- ✓ METALS
- ✓ MINING
- ✓ PULP & FIBER
- ✓ RETAIL
- ✓ TELECOM
- ✓ TEXTILES
- ✓ TRADING

Birla Carbon: Long History of Global Presence

BIRLA CARBON has been serving a global customer base for **more than 150 years** – with an annual carbon black production capacity exceeding **2 Million** metric tonnes across **100+ unique grades**. With a team of more than **2,400 people**, BIRLA CARBON operates in **12 countries** on **5 continents** across **16 different plants** – including **2 state-of-the-art** research centres in the US and India.



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Net Zero Carbon Emissions by 2050



PURPOSE

Share the Strength

VISION

To be the most respected, sustainable and dynamic carbon black business

MISSION

To be the first global carbon black company to achieve net zero carbon emissions



RESEARCH
to discover new ways for the capture and conversion of carbons



REDUCE
dependence on traditional processes in engineering, operations, and R&D



REPLACE
with alternative energy and feedstock



REPURPOSE
materials for increased value by circularity

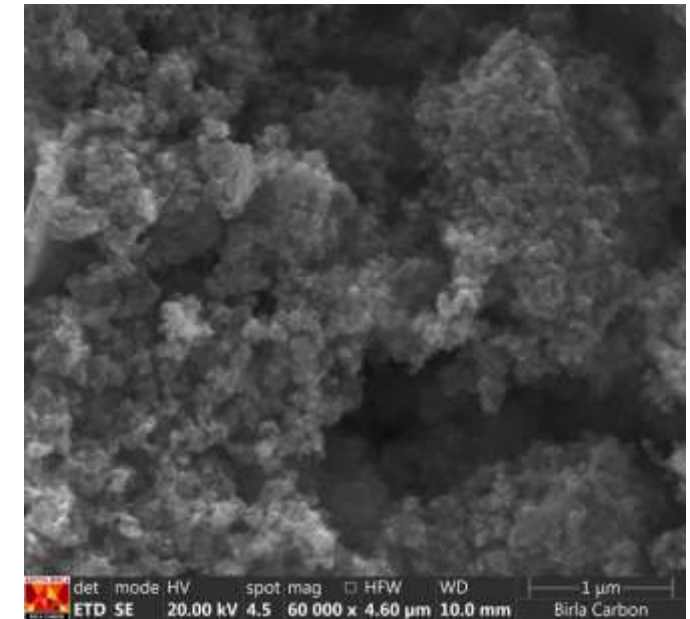
'SHARE THE FUTURE'

Lead the change to a Net Zero future through strategic collaborations
Drive circularity by providing a range of 'sustainable' carbon solutions



A Circular Solution

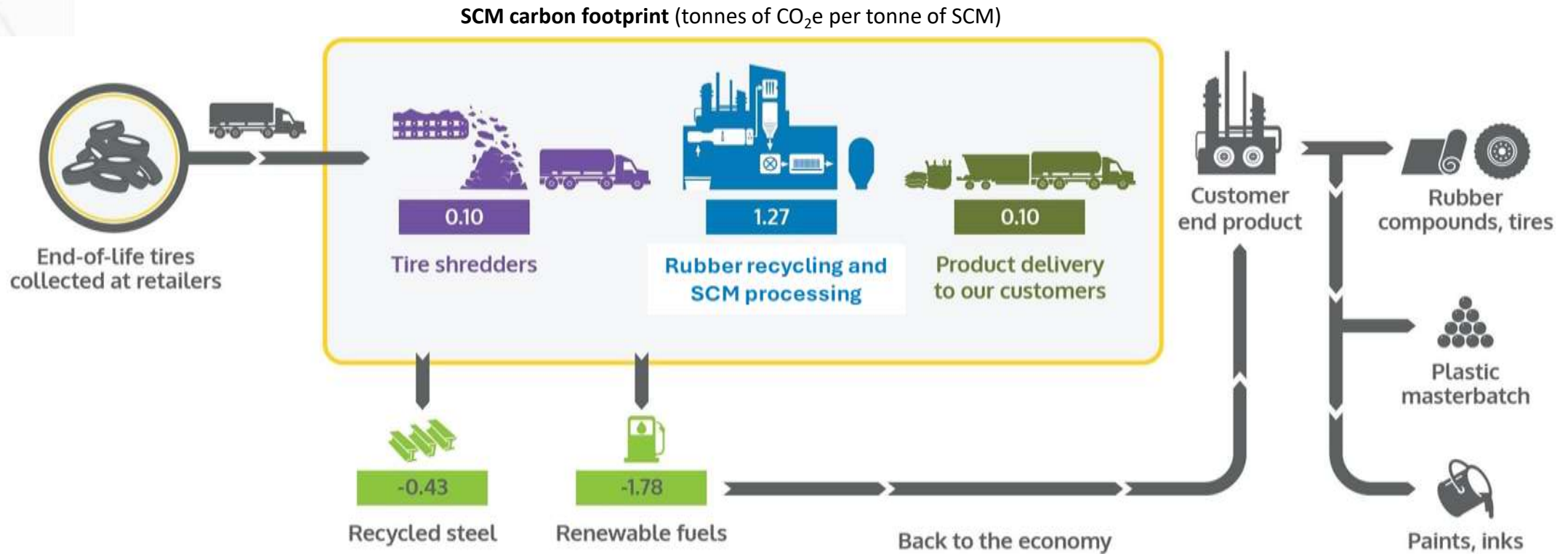
- To meet our customer's requests for circularity at scale, Birla Carbon has introduced a Sustainable Carbonaceous Material (SCM) to market
- Sustainable Carbonaceous Material (SCM) is created through the pyrolysis of end of life tires
- SCM is not carbon black, although it shares many of its characteristics
 - Offer a sustainable alternative to traditional Carbon Blacks



High magnification micrograph of SCM



SCM Carbon Footprint



- For each MT of SCM produced, system captures 0.73 tonnes of CO₂e.

Birla Carbon's average carbon footprint is 2.4 tonnes CO₂e per tonne of carbon black
 LCA's generated using ISO 14040 methodology. Feedstock 'cradle' to customer 'gate' used as boundary conditions



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Formulating Challenges of SCM



- Predicting SCM performance is not like carbon black
- Fundamental properties relevant to predicting carbon black performance do not always hold up for SCM

Carbon Black

- Surface area
- Structure
- Surface chemistry
- Porosity

SCM

- Milled particle size
- Transmission
- Ash content



Fundamental Properties



- As Sustainable Carbonaceous Material is not carbon black, traditional colloidal properties have been found to be an unreliable measure of application performance and in some cases not possible
- The key properties of SCM that relate to final product performance have been identified as
 - Particle Size
 - Transmission
 - Ash Content
 - Pellet properties (beaded products)
- The final shipping specification will be based on these identified measures rather than traditional colloidal measurements
 - Traditional Carbon Black colloidal properties **will not** be included in the specification but typical values can be provided



SCM Specifications



Properties	Unit	Value	Tolerance	Method
Particle Size Distribution, D ₉₇	μm	11	± 2	Dry PSA
Ash Content	%	20	± 4	D1506
Sieve Residue 325#	ppm	100	Max	**
Fines Content (Bulk)	%	8	Max	D1508
Heating Loss (Bulk)	%	1.5	Max	D1509
Transmittance of Toluene Extracts	%	95	Min	D1618
PAH content, each of the 8 listed on EU N. 1272/2013	ppm	1	Max	D7771

** ASTM D1415 Sieve residue test not reliable for SCM. New test method and limits under investigation

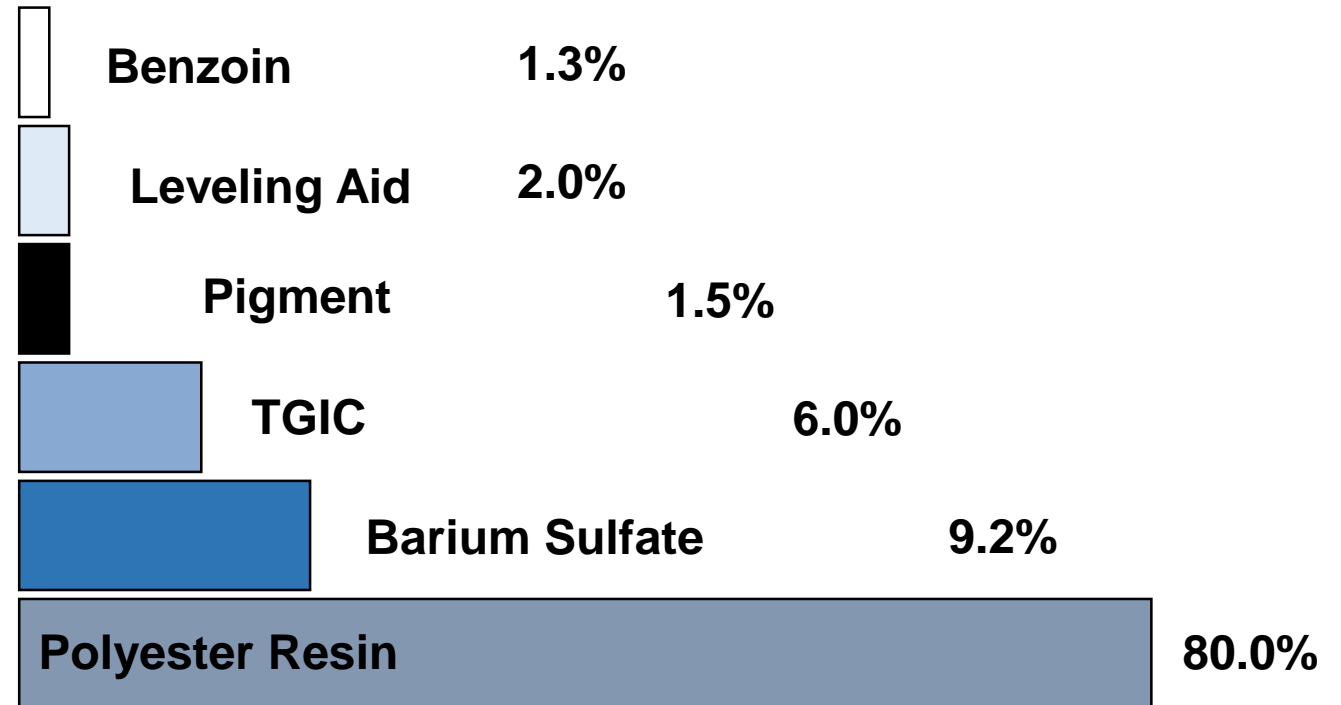


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Experimental: Formulation

- Compared SCM 1:1 to medium color (Med CB) and tinting carbon (Tint CB) black types
- Included additional 20% to compensate for ash content



Experimental: Dispersion and Test Protocol



- Ingredients pre-blended, compounded by twin-screw extruder
- Single extrusion pass only
- Compared performance of color, appearance, flow and weatherability
 - Full shade color
 - Tint strength
 - Pill flow
 - Xenon exposure

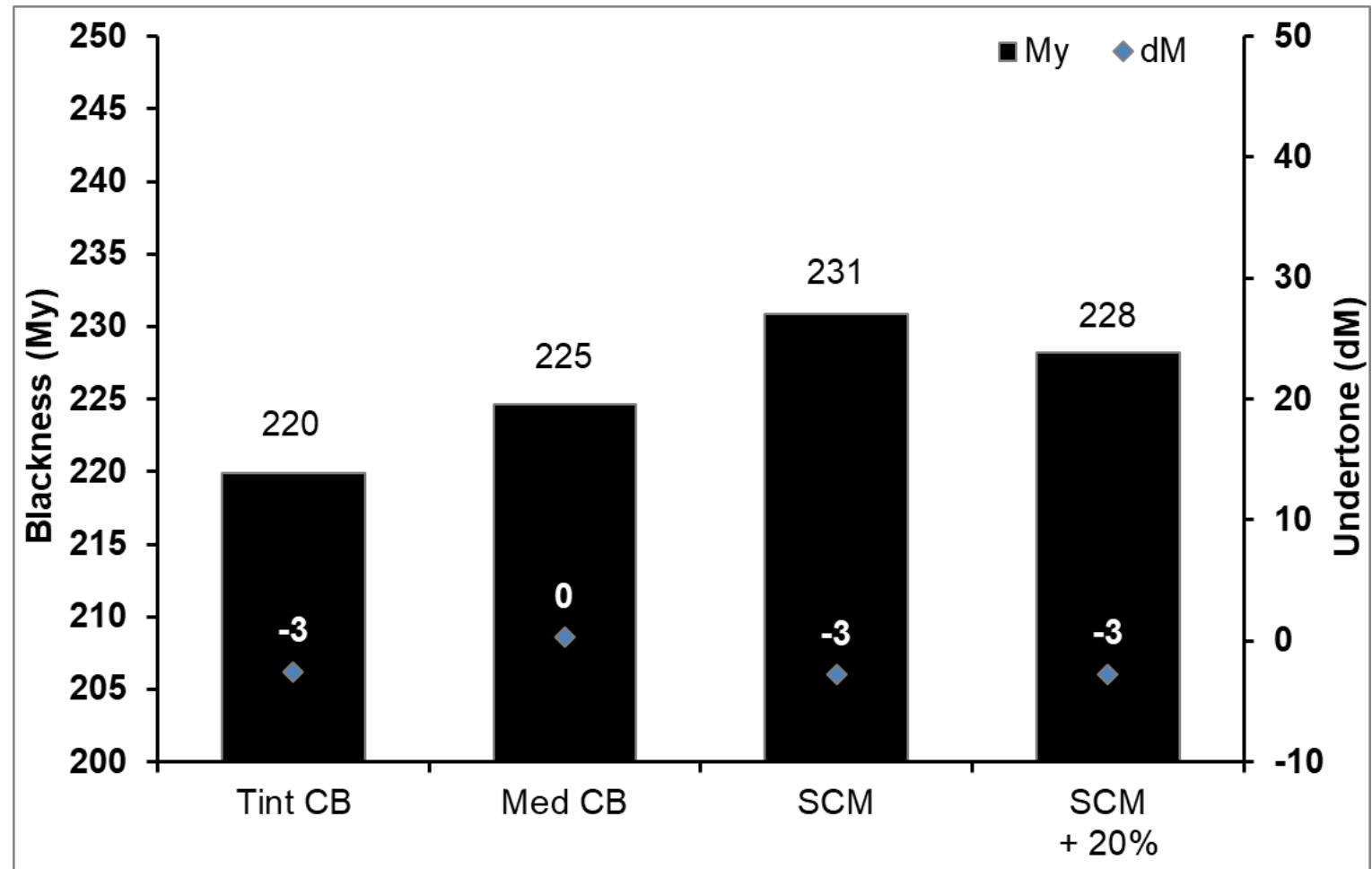


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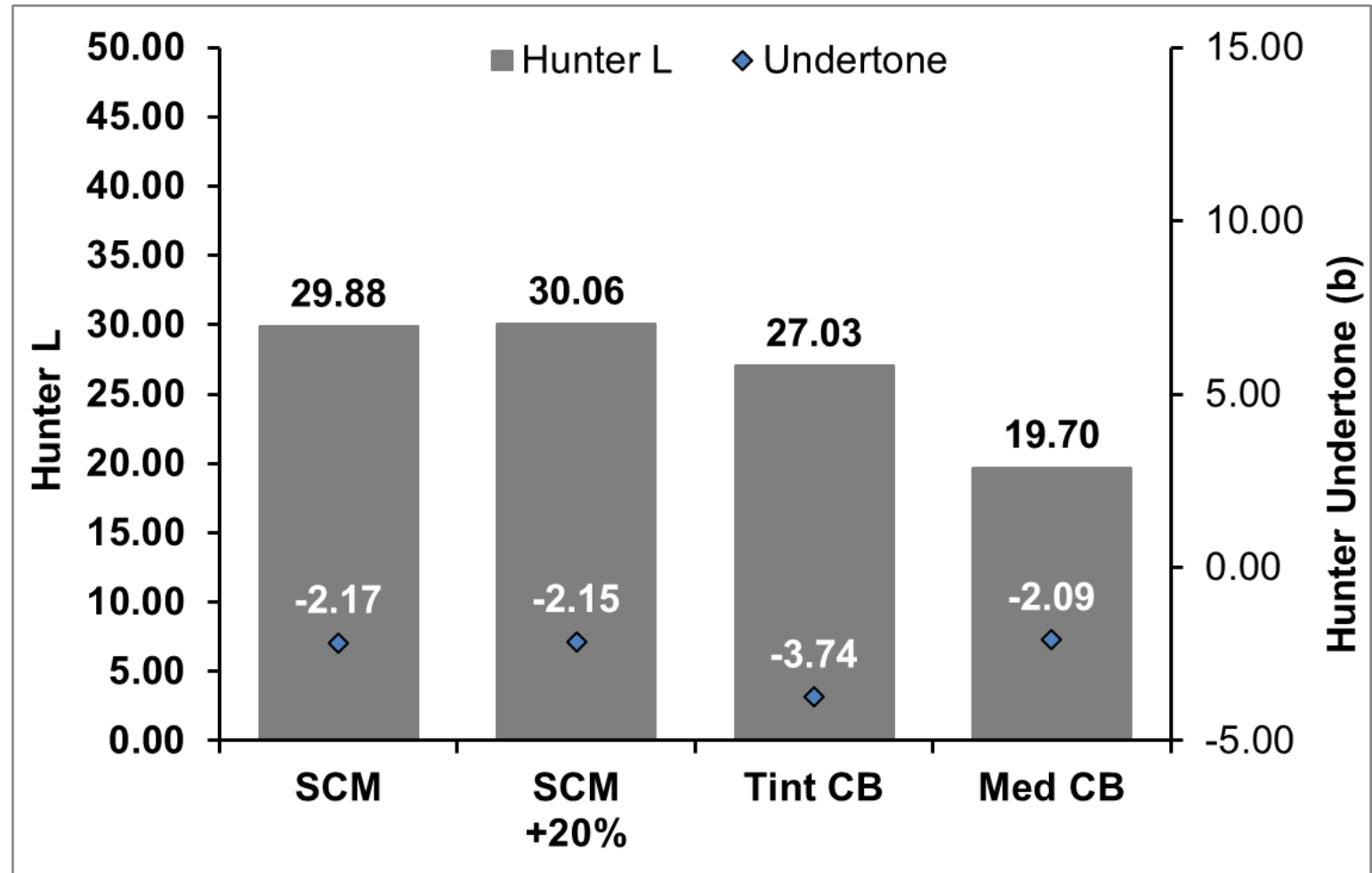
Color in Black PE-TGIC Coating

- Good color development with standard conditions
- No improvement when compensating for ash content of SCM



Color in Gray PE-TGIC Coating

- Tinting not as strong as traditional carbon black
- Tone comparable to a medium color product



Effect on Pill Flow



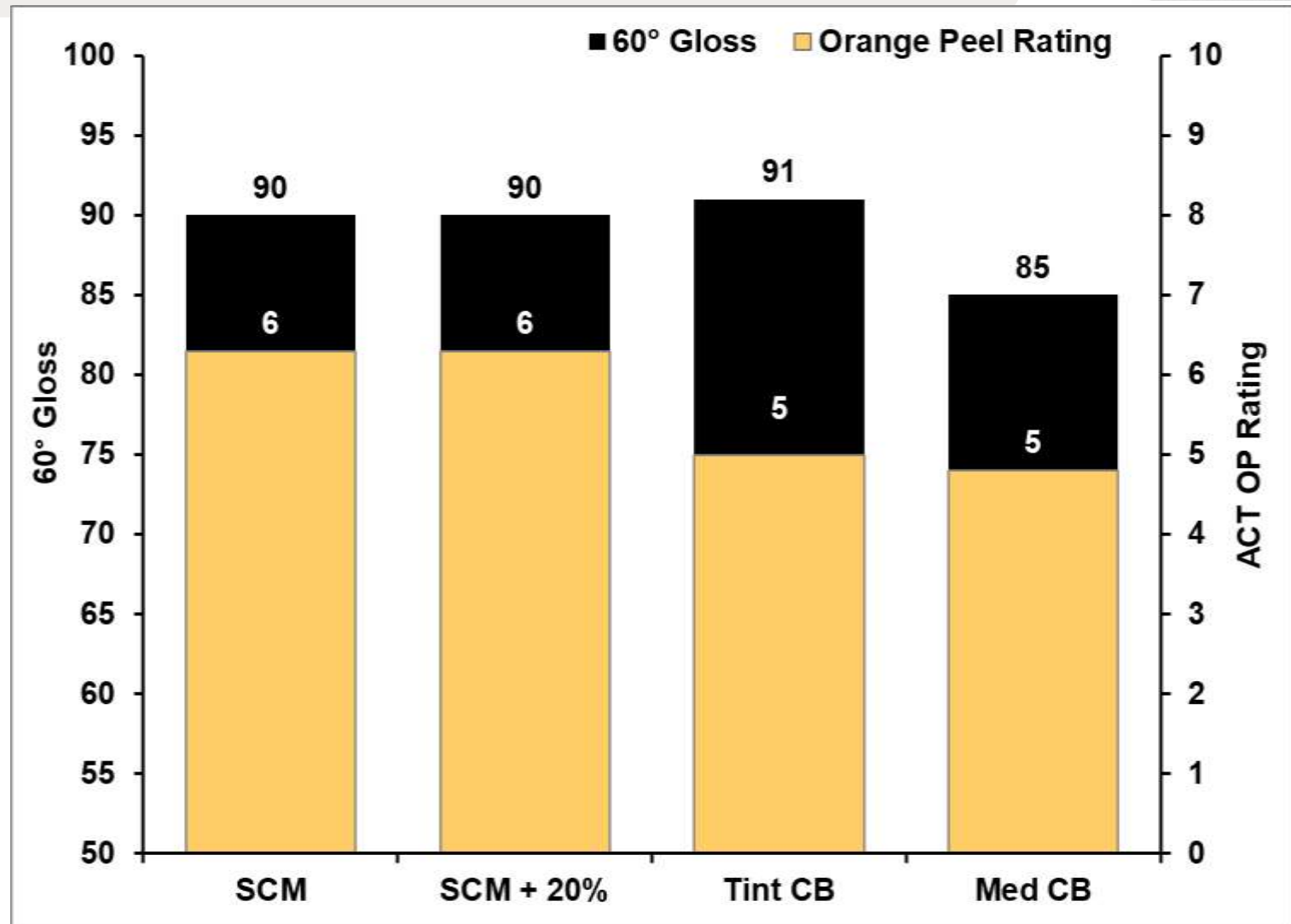
Product	Pill Flow (mm)	MEK Rub
SCM	86	> 50
SCM +20%	89	> 50
Tint CB	90	> 50
Med CB	76	> 50

- Good pill flow
 - Lower viscosity for extrusion
 - Positive impact on flow and leveling
 - Allows formulation latitude

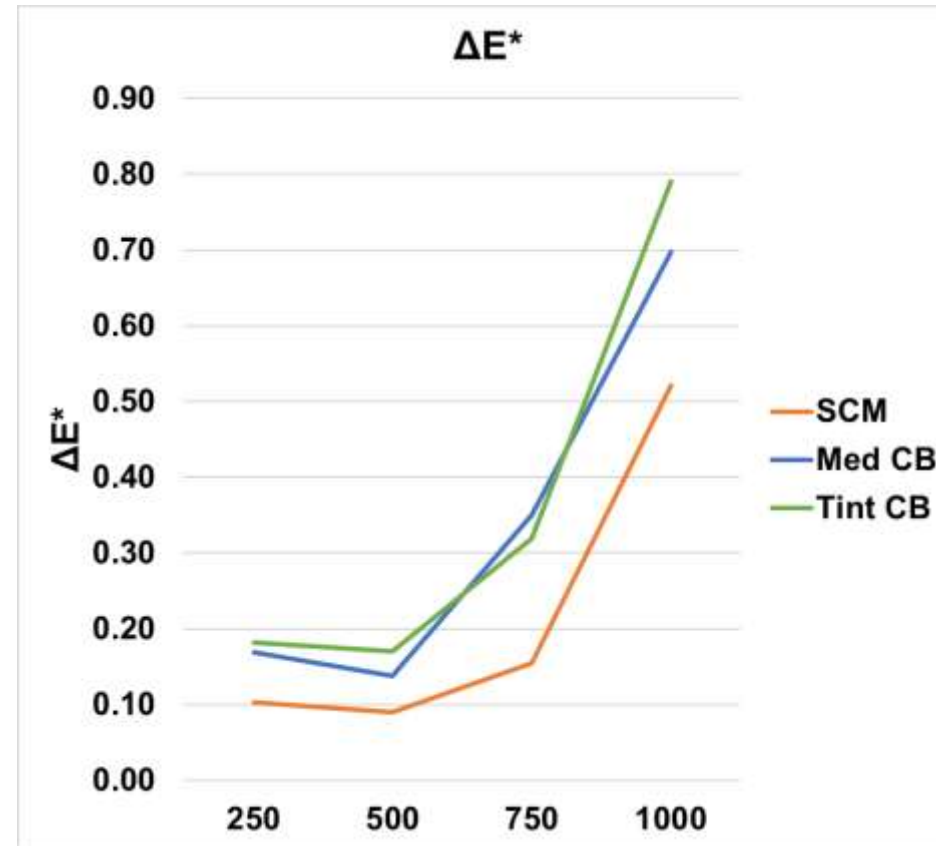
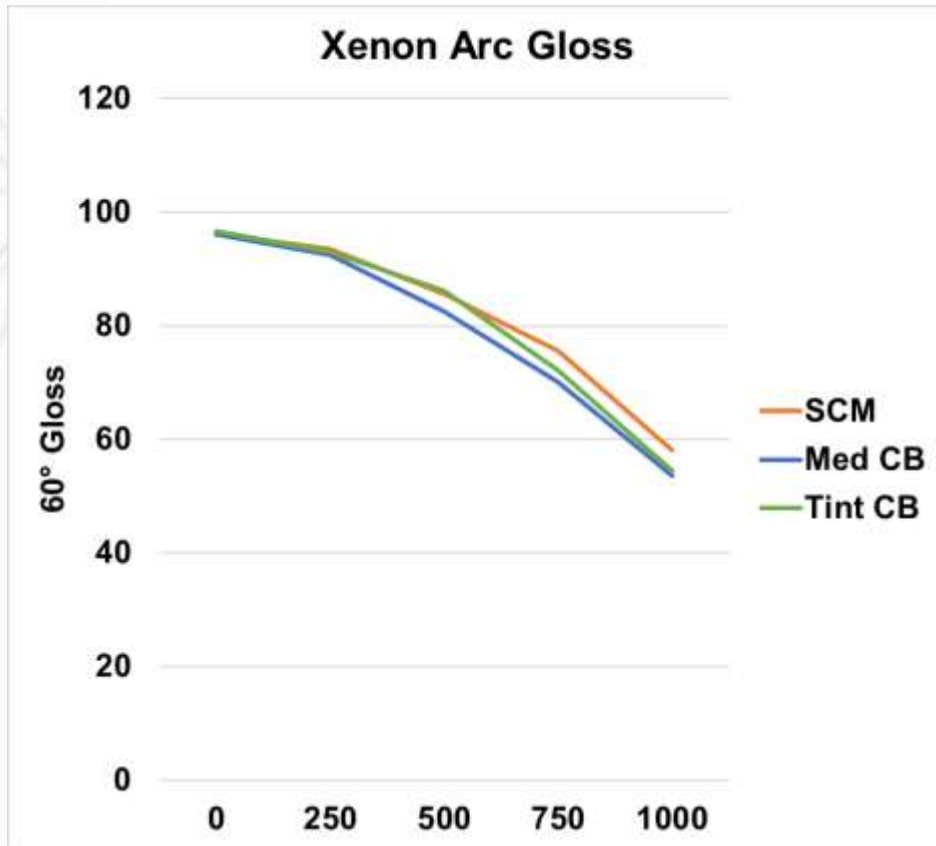


Effect of SCM on Appearance

- Acceptable gloss and appearance
- Flow properties give advantage over medium color carbon black



Potential for Industrial Applications



- Good color and gloss retention in a black PE-TGIC coating after 1000 hour Xenon



Take Aways



- SCM provides alternative to carbon black for industrial applications
 - Color and appearance in full shade applications is promising, medium color carbon black performance expected
 - Flow and leveling offer formulation latitude, viscosity reduction during extrusion
 - Good weatherability offers potential for outdoor applications



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Next Steps and Challenges



- Expand on use of eco-friendly formulation ingredients
 - Initiated studies with circular powder coating resins
- Explore tint strength improvements
 - Formulation, dispersion or SCM properties?



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Questions?



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