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FOUR KEY PRINCIPLES

1. Find reliable supportive trends
2. Manage a portfolio of critical materials and technologies
3. Be the low-cost producer
4. Defend the market leadership in our niche markets
10 YEAR EBITDA VOLATILITY

• The 10 year average max / min EBITDA multiple of the 9 business units is 7.1

• The 10 year average max / min EBITDA multiple of the total consolidated business is 3.0
ORGANIZING GROWTH

• A-Projects: Routine Organic Growth of Existing Businesses
• B-Projects: Non-routine Expansion of Existing Business Lines
• C-Projects: Transformational Projects
CONSTRAINTS OF STRATEGY EXECUTION

1. Focus on organic growth projects
2. Maintain a conservative balance sheet
3. Build project management teams
4. Enhance (not diversify) current portfolio
5. Make acquisitions through industry consolidation only
THREE BREAKOUT TRENDS

• Rise in Battery Materials
  ➢ Drivers: electric cars, renewable energy, grid stabilization

• Growth of the Refinery Catalyst Market
  ➢ Drivers: IMO 2020, Middle East refineries

• Shifts in Aerospace Engine Technology
  ➢ Drivers: weight reduction and higher operating temperatures
MIBRA MINE – MINAS GERAIS, BRAZIL
THE GROWTH OF THE REFINERY CATALYST MARKET

Increase in low-sulfur oil consumption necessitates additional fresh resid catalyst, resulting in substantially more spent catalyst (factor of approximately 1.7x).

Source: BloombergNEF, IEA.
“CAMBRIDGE I” OHIO
JOINT VENTURE: AMG & SHELL

AMG Advanced Metallurgical Group N.V.

Shell Catalysts & Technologies

BV (name not yet finalized in JV agreement)

Global spent catalyst recycling expansion by end-to-end solutions
AMG TECHNOLOGIES

Furnace Systems

Heat Treatment
ModulTherm

Own & Operate

Metallurgy
VIDP furnace

AMG Titanium – Titanium Aluminides
## ENABLING CO₂ REDUCTION

**Enabled CO₂ Reduction - 2018**

<table>
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<tr>
<th>Division</th>
<th>Business Unit</th>
<th>Net CO₂ Reduction (tons) *</th>
<th>Technology / Product</th>
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<tr>
<td>Technologies</td>
<td>Engineering</td>
<td>43.5 million</td>
<td>Thermal Barrier Coatings &amp; Turbocharger Wheel Castings</td>
</tr>
<tr>
<td></td>
<td>Titanium Alloys</td>
<td>5.0 million</td>
<td>Titanium Aluminides</td>
</tr>
<tr>
<td>&amp; Coatings</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Critical Materials</td>
<td>Vanadium</td>
<td>1.2 million</td>
<td>Steel Alloying / Light weighting</td>
</tr>
<tr>
<td></td>
<td>Graphite</td>
<td>1.0 million</td>
<td>Graphite Insulation</td>
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**Total net CO₂ reduction (2018): 50.7 million tons**

* Net of operating emissions