Plastics Compounding: Potential Development for the Middle East Market

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Global Compounding Business Overview
Polyolefins Compounding: Industry Profile

- **Size of Polyolefin Compounding Business**
  - Global Revenue: $15 Billion
  - Global Demand: 11 Million tons (55% PP, 45% PE)
  - Global Growth Forecast: 4.5 – 5.0%
  - GCC Estimated Demand: 185 KTA

- **Nature of Business**
  - Fragmented due to low entry barriers
  - Encourages new entrants, especially in regional markets
  - More than 50% market share is controlled by top 15 compounders
Why Compounded Plastics?

Compounded Plastics to enhance features like
- Mechanical/Physical and Thermal Properties
- Opticals (color/visuals)
- Functional properties
- Reduced cost

Ingredients play key role to enhanced compound properties
- Fibers to increase strength and stiffness
- Plasticizers for flexibility
- Lubricity of molded parts
- Antioxidants for high temperature stability
- UV stabilizers for resistance to sunlight
- Fillers for economy
- Flame retardants and smoke suppressants
- Conductive fibers for electrical properties
- Color concentrates for colored plastic
- Polymer alloys & blends for performance plastics
Global Demand of PP Compounds: Sectors

- Total PP Compound Demand in 2006: 4.7 MMTA,
- Expected demand in 2015: 7 MMTA
- Automotive largest sector with 55% followed by appliances sector with 19%
- Strong demands in automotive attributed to increasing and ongoing substitution

Total Global Demand Growth - AAGR 4.4%
Total Global Capacity: 5.5 MMTA

Source: Nexant 2005/Internet
Global PP Compound Producers spread

North America
- Spartech Corp
- Schulman
- Polyone
- ExxonMobil
- Washington Penn
- LBI
- Advanced Comp.
- Ferro
- Solvay
- RheTech
- Prime Polymer JV
- Japan PP JV
- Sumitomo

Western Europe
- LBI
- Ravago
- Borealis
- ExxonMobil
- Sabic
- Schulman
- Dow
- Prime Polymer (Toll)

China
- Kingfa
- LBI
- Prime Polymer
- Japan PP JV
- Sumitomo JV

Japan
- Japan polypropylene
- Prime Polymer
- Sumitomo
- LBI JV

Asia Pacific (Rest)
- LBI
- Grand Siam
- Prime Polymer
- Japan PP JV
- Sumitomo (Toll)

LBI got global presence in PP Compounding

Source: Nexant 2006
Major Trends In Polyolefin Compounding

- From Integrated to Independent..
  - Traditionally integrated to polymer production, transitioning to independent
  - Cost structure/pressures in compounding different than polymer production
  - Customer base quite fragmented and technical specifications intense for polymer producers

- Rapid Consolidation & Globalization in Compounding Industry..
  - Big compounders are getting bigger – Polyone, Schulman and King Fa are getting bigger while ICO and other regional players are being consumed
  - Globalization seems to be key for serving global customers of compounding base in Auto and Packaging industry
  - Regional players thrive by partnering with global or other regional counterparts

- Technology and Innovation Key to Success..
  - Innovation in materials used such as nano-composite and other reinforcing agents provide unique properties akin to metals and engineered plastics
  - Intensive research and technology improvement in compounding equipment and techniques

Provides Industry Continued Growth Options..
Compounding Fundamentals

How

Why

Where
Plastic Compounding....

Compounding is the process of incorporating additives, modifiers into Polymer for achieving uniformity on a scale appropriate to the quality of the articles subsequently made from the compound.

**Polymers**
- PP
  - Homo Polymer
  - Block Copolymer
- PE
- Elastomer

**Additives**
- Process Aid
- Heat Stabilizer
- UV stabilizer
- Special Additives
- Colourants

**Fillers**
- Calcite
- Talc
- Glass Fiber
- Others

**Essential for Compounding**
- Proper mixing & blending techniques/process
  - Uniformity
  - Homogeneity
  - Dispersion
- Right components and concentrations
  - Cost
  - Performance
  - Durability

**Special Modification**
- Warpage and An-isotropic Shrinkage
- Sink Marks
- Visibility of Weld Lines
- Scratch Resistance
- Paintability
**Compounding Operation**

- Polymers
- Additives
- Reinforcement/Fillers

- Compounding Operation:
  - Polymers, additives and fillers are melt mixed in twin screw extruder to give homogenous compound.
  - Compound is extruded in form of strands, cut into pellets.
  - Pellets are dried and packed.

- Diagram:
  - Extrusion
    - Polymers, additives and fillers are melt mixed in twin screw extruder to give homogenous compound.
  - Strand pelletizing
    - Compound is extruded in form of strands, cut into pellets.
  - Underwater pelletizing system
  - Drying
  - Packaging
    - Pellets are dried and packed.
Where is used Compounded Plastics

**Industries Served:**
- Construction
- Auto
- Wire and Cable
- Durables
- Consumer Products
- Industrial Applications
- Aerospace
- Electrical & Electronics
- Health Care

**Replacing:**
- Metals
- Wood
- Natural Rubber
- Expensive Engineered Plastics

Mineral Filled PP compounds dominate the market...

Source: Nexant 2005

Focusing on novel compounding & blending techniques...
PP Product categories/stiffness vs. other Polymers

PP Compounds meet entire properties demand.
Neat PP has lowest density.
Automotive: A success story for PP

- 12% of PP total consumption is used in cars (Europe)
- 30 to 40% of all plastics is PP
- More than 60 kg of PP used in modern car nowadays
- PP compounds got the highest growth rates in emerging countries

<table>
<thead>
<tr>
<th>Model</th>
<th>Car Maker</th>
<th>PP (kg/car)</th>
<th>% of total plastics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Citroen C4</td>
<td>PSA</td>
<td>90.2</td>
<td>56</td>
</tr>
<tr>
<td>Aygo</td>
<td>Toyota</td>
<td>47</td>
<td>52</td>
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<tr>
<td>Auris</td>
<td>Toyota</td>
<td>71</td>
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<td>Yaris</td>
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<td>Fiat 500</td>
<td>Fiat</td>
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<td>49</td>
</tr>
<tr>
<td>Opel Corsa</td>
<td>GM</td>
<td>65</td>
<td>44</td>
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<tr>
<td>Mondeo</td>
<td>Ford</td>
<td>72</td>
<td>41</td>
</tr>
<tr>
<td>Mercedes C-class</td>
<td>Daimler-Benz</td>
<td>72</td>
<td>34</td>
</tr>
</tbody>
</table>

PP Compounds volume in Automotive application is highest
PP Consumption in Automotive: By Region

<table>
<thead>
<tr>
<th>Region</th>
<th>2006</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Europe</td>
<td>32.0%</td>
<td>28.3%</td>
</tr>
<tr>
<td>America</td>
<td>28.0%</td>
<td>26.8%</td>
</tr>
<tr>
<td>Japan</td>
<td>19.0%</td>
<td>17.1%</td>
</tr>
<tr>
<td>China</td>
<td>9.0%</td>
<td>13.4%</td>
</tr>
<tr>
<td>A/P</td>
<td>8.0%</td>
<td>9.3%</td>
</tr>
<tr>
<td>Others</td>
<td>4.0%</td>
<td>5.1%</td>
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</tr>
</tbody>
</table>

Total Consumption: 3454 KT for 2006 and 4394 KT for 2011.

PP in automotive as Compounded and net polymer.

China & Asia Pacific Demand grow to 23% in 2011.

Source: Townsend 2007
PP compound incorporation in light vehicles are increasing by replacing Neat PP.

PP compounds usage in light vehicles increase and neat PP usage decreases....

Source: Townsend
Automotive Industry Trends & Developments

Vehicles

- Low Cost Small Car
- Green Vehicles - Adoption of Alternate Fuel (CNG, LPG, Bio-fuel, solar etc)
- MUV/SUV becoming second family vehicle
- Mandatory Fuel Efficiency Regulations
- Enhanced Safety features
- Emphasis on Aesthetics & Comfort
- Increasing Plastics penetration per car

Materials

- High Flow, High Impact-Stiffness balance
- Soft touch, Odourfree materials for steering wheel, handles etc
- Metallic Finish & Good Paintability
- Low-Density Dashboard & Interior Trim
- PP LFRT in Front End Module Carrier

Automotive Industry on growth track
Advantages of Plastics in Automotive Case Study

- 100 Kg of Plastics reduces weight of car by 200 – 300 Kg
- Modern car saves 0.5 liter of fuel on every 100 km of travel
- Every light car saves 750 liters of fuel in its life time
- Lesser the fuel consumption, lesser is the CO₂ emission
- EC aimed to reduce average fleet CO₂ emissions for new passenger cars from today’s level of 160g/km to 130g/km by 2012, a reduction of 19%

... Contribute to Fuel saving & reduce CO₂ emissions

Source: European Plastics News 2008
Polypropylene Compound in Automotives - Interior

Key Requirements

- Good Scratch resistance
- Low emission
- Low smell
- Medium to high impact
- Good dimensional stability
- High Flow
- Low gloss
- Sound dampening
- Stain resistance to auto-fluids, grease, soap solutions.

Interior Applications

- Dashboards
- Dashboard carriers
- Pillar claddings
- Door pockets
- Door panels
- Consoles
- Chairs
Polypropylene Compound in Automotives - Exterior

Key requirements
- Good flow
- Good processability
- No surface defects
- Good paintability
- Good dimensional stability
- Excellent UV resistance
- High low temperature impact

Applications
- Bumper
- Bumper spoilers
- Lateral sidings
- Rocker panel
- Body panel
- Wheel arch liners
Polypropylene Compound in Automotives - Under Hood

Key requirements

- Good balance of stiffness and impact properties
- High impact properties at low temperature
- High HDT
- Low shrinkage
- Light material
- Low emission and odor
- Scratch resistance
- Low vibration
- Easy to paint
- Good processability

Applications

- HVAC – Heating Ventilation Air conditioning
- Batteries
- Battery covers
- Electronic housings
- Air ducts
- Splash shields
- Pressure Vessels
- Reservoirs
- Engine Covers
Polypropylene Compound in Automotives - Under Hood

**Key requirements**

- Good impact stiffness balance
- High impact properties at low temperature
- Excellent Aesthetics
- Low moisture Absorption
- Excellent Chemical Resistance
- Good electrical properties
- Excellent Processability

**Household Appliance**

- Washing machine tub, refrigerator trays and shelves, housings for cooker hoods, Dish washer drum.

**Electrical/Electronic Appliances**

- Plates for electrical switches, engine cover plates, electrical condenser housings.
Automotive Exterior-replacing metals
- Provides safer, lighter and more economical alternative

Multi layer Barrier Packaging replacing glass and metals
- Weight Reduction and better barrier properties- plastic container weighs a fraction of metal or glass coffee jars in the picture here

Aircraft Exteriors & Wind Mill Turbines replacing Aluminum alloys
- Weight Reduction/Fuel Efficiency

Siding and Roofing materials in home construction replacing wood and metals
- Better Durability, Insulation, Energy Saving & Weathering properties

Compounds has potential to replace many more.....
**PP Compound: Price difference** (relative to HomoPP, $/MT)

**North America**

- **+300**
  - Glass Filled
    - (25% glass, 10% mineral filled)

- **+700**
  - TPO (35% elastomer content)

- **+1000**
  - TPV (65% elastomer content)

**West Europe**

- **+300**
  - Homopolymer PP Price

- **+750**
  - TPO (35% elastomer content)

- **+1100**
  - TPV (65% elastomer content)

- **-50**
  - 35% Talc Filled (Mineral Filler)

- **-200**
  - 20% Mineral Filled PP most common in Europe.....

Source: Nexant 2005

TPV costly due to small volume product.....
Compounding Business Development in Middle East
Automotive Industry in GCC: Potential Driver

GCC Auto industry in 2010: $17 Bn
GCC Auto industry in 2014: $21.5 Bn
Estimated Annual growth: 10%

Low fuel cost, high per capita income and growing population are driving rapid development of automotive market in GCC.

- Government Incentives
  - Favourable tax environment with no personal, corporate, value added or withholding tax
  - Large no of free trade zone

- Sound Macro-economy
  - High per capita GDP, high standard of Living, relatively low inflation

- Excellent Infrastructure and logistic support systems

- Strategic Location
  - Easy access to huge market like MENA, India, South East Asia and CIS countries.

- Base for raw materials like Plastic, Aluminium & Glass

- As a result of climatic conditions and a rugged terrain, there is a vibrant and growing market for accessories and spare parts

Source: Business Monitor International
Major Automotive Industry in GCC: Potential Driver

UAE:
- Ashok Leyland Motors’ s automotive plant in UAE started with a assembling capacity of 2000 units buses & trucks annually.
- Swedish automaker Scania’s JAFZA plant assembles 1400 units vehicles per year in UAE.
- Volgren & Praktiko have announced establishment of vehicles assembling unit in UAE.
- JEFZA set up at Dubai is to house companies dealing in vehicles and related service and spare parts.
- Dubai autozone is free zone to attract foreign direct investment, a SEZ to cater GCC market.

KSA:
- Mercedes Group, Volvo Group & Man have assembling unit in KSA.
- Isuzu Motor to establish new automotive assembly plant in 2012 with initial capacity of 600 units trucks per year and will expand to 25,000 units per annum in future.
- In KSA, Gulf Automobile Manufacturing Company will start the plant in a $100 million agreement with the Saudi Authority for Industrial Cities and Technological Regions. In 1st phase, the factory will have a capacity of 15,000 cars. In 2nd phase, at Sudair, capacity will grow to 300,000 cars.
- The Saudi Clusters Program was initiated by the Government of Saudi Arabia to develop and to provide support to automotive industries in vehicle assembly, components manufacturing etc.

Bahrain:
- Vanguard’s vehicle assembly unit in Bahrain.

Inevitable Growth in Plastic compounding and Processing Industry in GCC

Source: RAK Investment Authority study 2009
PP Compounds in GCC & ME

GCC Market Size = 9 kta

ME Market Size = 21 kta

GCC Region

ME Region

Source: TASNEE PP/PE Compounding Market Study
Automotive Scenario in Middle East

- By 2015, Middle East vehicle sales will be led by Iran, KSA, UAE, Kuwait and Qatar.
- Middle East automotive production will be led by Iran & Egypt.
- Vehicles demands enhances the scope for more Polyolefin compound production in ME. Also enhances demand for spare parts.

Source: Global Insight 2010
TASNEE’s Strengths in Compounding: Integrated Regional Player in Polyolefins

- Integrated competitive raw materials
  - PP & PE compounded products
  - Complements Conversion Park concept
- Sufficient Regional Market Size
  - ME & GCC growing demand base
- Synergy with existing business & world class R&D TPRC
  - Low overheads and cost structure for operations and innovation
- Broadens product portfolio and offering to customers
- Products designed mainly for automotive and electrical appliances – these are tailor made products
- TASNEE Compounding is completely back integrated

Access to proprietary compounding technology and products from LBI enhance TASNEE’s strength in Compounding
TASNEE Compounding facility

Line 1
PP base
20 KT

PP Filled with Talc
- 20%
- 40%

PP Filled with CaCO3

PP Filled with Glass Fibers
- Different loading levels
- Short and long fibers
- Treated and non treated

Line 2
PE base
20 KT

PE colored for pipe use
- Blue for drinking water
- Y/O for gas distribution
Thank you