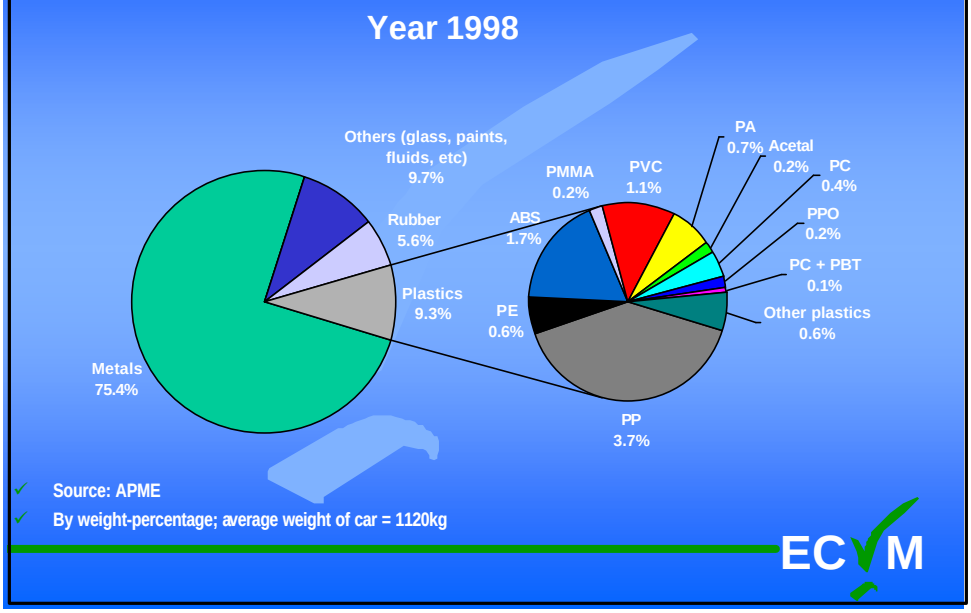
PVC in automotive

Examining the trends and drivers behind the growth of PVC for dashboard applications

Summary

- ✓ Introduction
- ✓ The evolution of PVC-slush: past & present
- ✓ How PVC meets the increasingly stringent requirements of OEM's
- ✓ Future trends

Material-use in cars



- Source: APME
- By weight-percentage; average weight of car = 1120kg

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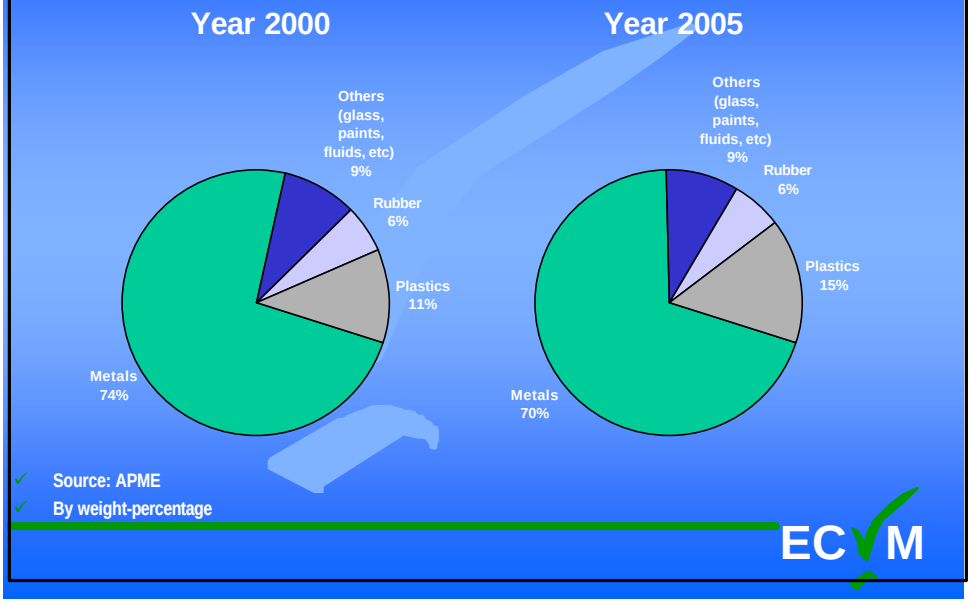
Material-use in cars



- Source: APME
- By weight-percentage

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PVC-use in cars

Interior

dashboard skins, carpets, door panels, consoles, arm rests, grips, interior seals, sun visors, seat coverings, luggage compartment covers

Exterior

body trim, window encapsulation, bumper spoiler, door steps, roof rack coverings

Others

underbody coating, battery separation plates, fuel line protection

Electrical wiring

cable insulation, moulded plugs

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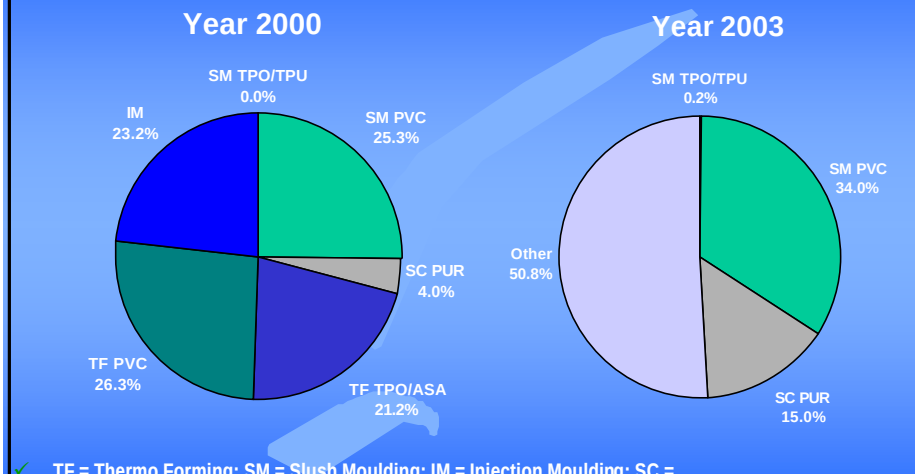
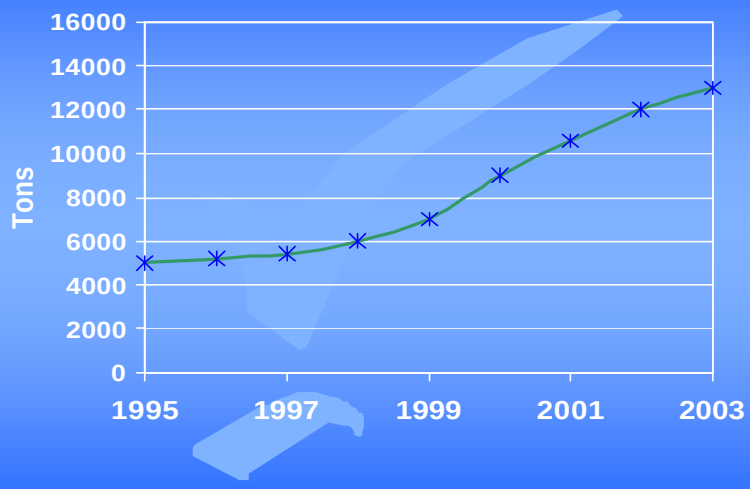
Plastics in dashboards



- TF = Thermo Forming; SM = Slush Moulding; IM = Injection Moulding; SC = Spray Coating

Market evolution: PVC-slush



- Total estimated European volume

Models with PVC-slush

Models with PVC-slush

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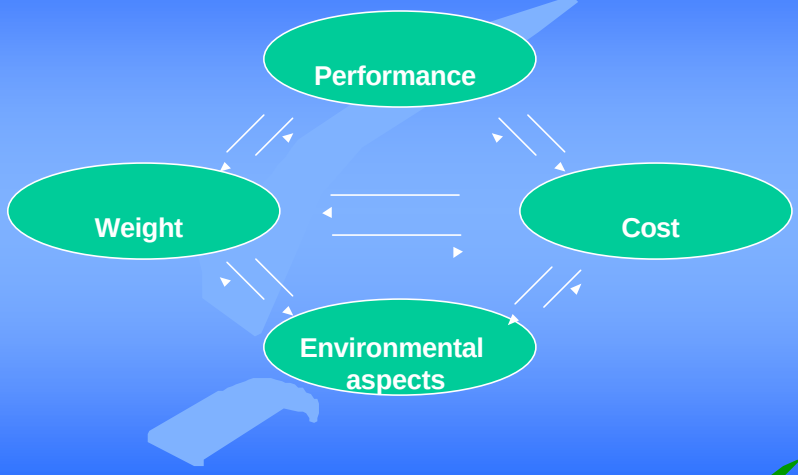
Material & process technology: basis for choice



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Material & process technology: basis for choice

- ✓ Performance:
  - ✓ Styling requirements
  - ✓ Visual appearance
  - ✓ Touch (Haptik)
  - ✓ Mechanical & physical properties
  - ✓ Surface properties
  - ✓ Ageing
- ✓ Environmental aspects:
  - ✓ Emissions
  - ✓ Recyclability

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Design freedom

- ✓ Source: VDI; "plastics in Automotive engineering" (Mannheim, 2003)

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Advantages of PVC-Slush Technology

- ✓ Cost / Performance
- ✓ Design Freedom
- ✓ Stress Free
- ✓ Esthetics (color, aspect, soft touch, grain)
- ✓ Scratch Resistance
- ✓ Easy Processing
- ✓ Available in any tailor made color
- ✓ Low fogging
- ✓ Perception of quality in car

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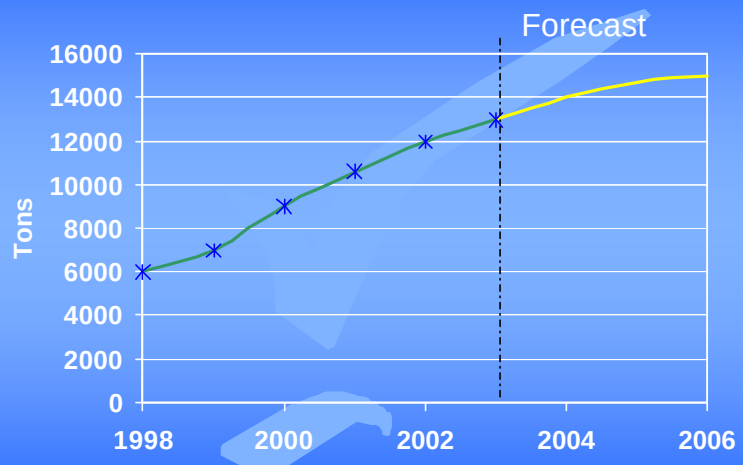
Market evolution: PVC-slush



- Total estimated European volume

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Reasons for future growth

- All classes of vehicles
- Other interior applications of PVC-slush (design uniformity)
  - Door panels
- Other car manufacturers

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Mechanical recycling of PVC automotive waste

Summary

- ✓ General
- ✓ Case study: instrument panels
- ✓ Re-use of recyclate

GENERAL

- ✓ Depending on source and quality of the waste
- ✓ Conventional and dissolution
- ✓ Critical success factors:
  - ✓ Easy collectable
  - ✓ High volume
  - ✓ Separation of materials
  - ✓ Origin (production or ELV waste)

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GENERAL

- ✓ Examples of collection and recycling in practice
  - ✓ Autovinyle (France)
  - ✓ WIPAG
  - ✓ Eco-care
  - ✓ Chaize
  - ✓ Vinyloop

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Case study: Instrument panels

- ✓ Production waste
- ✓ Origin is known
- ✓ Practically no ageing
- ✓ Easy collectable
- ✓ Types of waste:
  - ✓ Rejected skins
  - ✓ Trimscrap type I (PVC + PUR)
  - ✓ Trimscrap type II (PVC + PUR + carrier)
  - ✓ Rejected dashboards

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Case study: Instrument panels

✓ Recycling process:

Schreddering

Delamination

Separation

Cryogrinding or dissolution

PVC recyclate

Other applications

PUR

Carrier

PUR

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Case study: Instrument panels

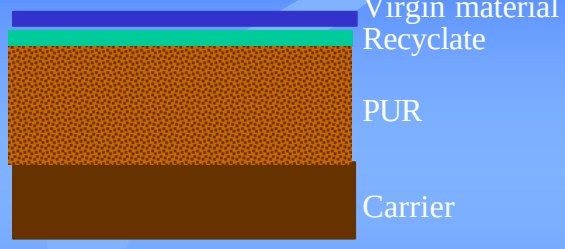
- ✓ Cryogrinding:
  - ✓ Free flowing powder
  - ✓ 97-99% pure
- ✓ Dissolution
  - ✓ See further

Re-use of PVC recyclate

- ✓ Requirements
  - ✓ Constant good quality
  - ✓ Constant supply
- ✓ Possible applications
  - ✓ Dashboards (double slush)
  - ✓ Door panels (double slush)
  - ✓ Flooring, ...

Double slush technology

- ✓ Principle:



- ✓ Top skin: colour, touch, stability, ...
- ✓ Second skin: barrier function, recyclate

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Double slush technology

- ✓ Double slush technology is used for Audi A2 and A4 (2000)
- ✓ Technology works
- ✓ Developments are ongoing with use of recyclate
  - ✓ Tests have been done with 25% of recyclate in second layer of dashboard on industrial installations
  - ✓ No major problems have been encountered

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Conclusions

- ✓ Experience mainly gathered with production waste
- ✓ Re-use in automotive is feasible
  - ✓ Double slush technology (second layer)
  - ✓ Constant supply and good quality
- ✓ ELV-waste
  - ✓ Acceptable to re-use? (ageing, composition, ...)

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