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Overview: Recycling and Repair

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"This presentation does not contain any proprietary or confidential information"

Why Recycle?

- *Development of cost-effective recycle strategies and technologies supports the deployment of advanced lightweighting materials*
- *Increased use of recycled/renewable materials is one of the three technology specific Materials goals for 2010*
- *Recovery and reuse of polymers and other advanced materials from ELV will---*
  - *---Increase materials supply options/decrease costs for automakers*
  - *---Decrease the carbon footprint of lightweighting materials over product life-cycle*
  - *---Conserve the embodied energy of these materials*

Strategic Framework

Economic use of advanced lightweight materials for automotive construction will be enhanced by both prompt recycling of scrap materials during manufacture, as well as recycling of end-of-life vehicles incorporating such materials.

Cost structures for materials such as aluminum and magnesium are strongly impacted by availability and cost of usable alloy scrap and retention of critical alloy properties.

For high- value materials such as carbon-fiber composites, there may be questions of capability to retain physical properties consistent with re-use applications.

Statutory mandates in a global economy and environmental considerations also dictate a need to recover or make usable many non-metallic materials that are not presently recycled. Development of viable strategies for control of materials of concern is also critical to enhancing recyclability.

Recycle Effort Structured as a CRADA

- *Organizing Theme*
  - *To achieve greater fuel-efficiency and safety, today's cars incorporate an increasing share of innovative lightweighting materials. While these materials greatly enhance efficiency during vehicle use, they can present special challenges to recycling.*

- *ELV CRADA Partners (US ELV CRADA Team)*
  - *Argonne National Laboratory/ U.S. Dept. of Energy*
  - *American Chemistry Council—Plastics Division*
  - *USCAR's Vehicle Recycling Partnership*

- *Objectives*
  - *Enable optimum recycling of all current and future automotive materials*
  - *Remove recycling barriers to use of advanced, lightweight materials*
  - *Continue to enable market driven vehicle recycling*

CRADA Background

- *Current CRADA initiated in August 2003*
  - *5 Years*
  - *~ $3 million per year (50% DOE/ 50% VRP and APC)*

- *Scope of the CRADA*
  - *a) examination of issues that prevent recycling*
  - *b) identification of technology to enable recycling*
  - *c) development and demonstration of technologies to recover resources and materials*
  - *d) examination of options for design modifications to provide for more effective recycling*
  - *e) examination of alternative materials to increase recycling*

- *Initial focus of research--- Post-shred technology*

A Brief History of Collaboration

- *1991* *Vehicle Recycling Partnership formed*
- *1994* ***First*** *CRADA (among VRP, Argonne and APC)*
  - *Dismantling*
  - *Seat foam recycling*
- *1997* ***Second*** *CRADA among VRP, Argonne and APC Demonstration of Argonne froth flotation technology (post-consumer appliance plastics)*
- *1999* *DOE PNGV (now FreedomCAR) funds*
  - *Argonne --- polymer matrix composite recycle*
  - *Aluminum Alliance --- LIBS alloy sorting*
- *2001* *ELV Recycle Roadmap released*
- *2003* ***Third*** *CRADA among VRP, Argonne and APC*
  - *Sustainable recycling*

Current R&D Portfolio of the Team Evolved from a Stakeholder Workshop Report

- *The recyclability of ELVs is presently limited and several technical and economic barriers need to be overcome to increase recovery and recycling*
  - *Lack of commercially proven technology to cost-effectively separate, identify and sort materials*
  - *Lack of profitable post-use markets*
  - *Collection infrastructure exists*
- *Development of technology to recycle today's materials will provide the basis for recycling of future materials*
- *Initial focus should be on post-shred technology*
- *Industry-wide collaboration is needed*
- *Worldwide technology needs to be tracked and information disseminated to users*

Projects Initiated Include…

- *Baseline Assessment of Recycling Systems and Technology (Available on Website)*
  - *Literature review, bibliography, technology assessment*
  - *Life-cycle studies of "post-shred" technologies*

- *Post-shred Materials Recovery Technology Development and Demonstration*
  - *Technology Development and Benchmarking*
    - Mechanical Separation Technology
    - Thermo-chemical Conversion Technology

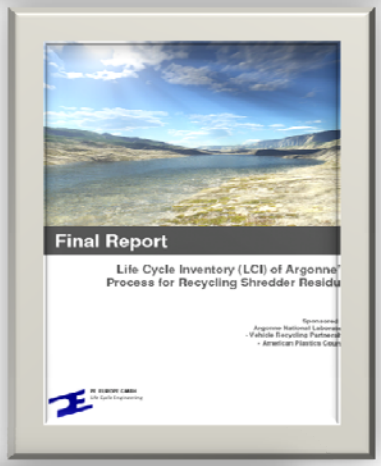
- *Compatibilization/compounding Evaluation of Recovered Polymers*
  - *Physical properties testing*
  - *Mold trials*

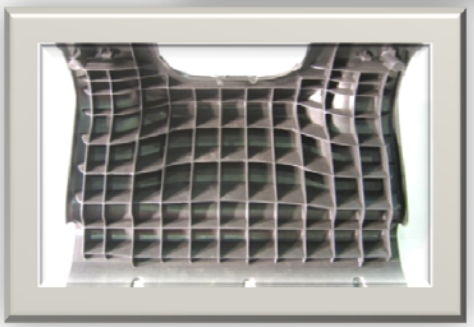
- *Development of Technology for Removal of PCBs and Other Substances of Concern*

- *Website Development to facilitate information dissemination*

CRADA Team Accomplishments Include…

- *Developed a modular LCA for evaluation of alternative "post-shred" recycle technologies*
- *Argonne confirmed the technical feasibility of recovering and reusing polymeric fractions from shredder residue*
- *Changing World Technologies confirmed the technical feasibility of converting shredder residue to liquid hydrocarbons*
- *Troy Polymers confirmed the technical feasibility of converting polyurethane foam from shredder residue to polyol initiators*
- *Advanced the technology for SOC control*
- *Developed a Web-site for information dissemination*
- *Recognized by the GPEC (Global Plastics Environmental Conference) Award for 2007*, *Enabling Technologies in Processes & Procedures,* Environmental Division, Society of Plastics Engineers





Visit the U.S. ELV CRADA TEAM Website

(www.es.anl.gov/Energy_systems/CRADA_Team_Link/Index.html.)