Life Cycle Assessment of Advanced Materials

- Apply life cycle assessment (LCA) to the production of materials
  - Specifically advanced & difficult to obtain materials
- Identify areas for environmental improvement of the processes involved
- Develop a set of recommendations for further research & development based on assessment

Sources: Fiona Doyle, ngonewsafrica.org

Many high performance products require advanced materials that have properties superior to those of conventional materials

Advanced materials are typically difficult to obtain and require many complex processing steps

LCA can be used to find the most ecological way to improve product manufacturing and material processing methods

Sources: Mark Hobbs, CNET, etap.com

Case Study 1: Rare Earth Oxides

- Major processes involved in rare earth oxide production were analyzed and areas with most significant contributions to impacts were identified to determine areas for improvement

Conclusions

- Intense energy and chemical use in processing methods play significant roles in environmental impacts of advanced material production
- In some cases, environmental performance depends on the impact categories being considered
- Materials and processes that have the most significant impacts in the case studies should be areas of focus for environmental improvements
- Many assumptions and proxy data needed to be used in analysis due to lack of available information

Case Study 2: Conductive Inks

- Several commonly used inks used in the printing of devices such as photovoltaics and electronics were assessed and compared

Conclusions

- Results from assessments can be used in tools such as the Eco Care Matrix to compare alternative processes to determine sustainable solutions
- The collection of primary data for processes would allow for more accurate results to be obtained
- The models created can be built upon in LCAs of products and systems that contain or use these materials

Sources: Siemens AG, Corporate Technology

Environmental impacts over life cycles of products and technologies are becoming increasing concerns for manufacturers, suppliers, designers, and consumers

Material extraction & processing represent important stages that can have significant impacts due to the potentially hazardous processes involved

Conducted “cradle-to-gate” LCAs of the production of:
- Rare earth oxides
- Conductive inks

Created models of processes using GaBi LCA software

Impact categories that were analyzed:
- Energy & water use
- Global warming potential
- Acidification potential
- Eutrophication potential
- Ozone depletion potential
- Photochemical ozone creation potential