

US EPA ARCHIVE DOCUMENT

Evaluating the Impacts of Nanotechnology via Thermodynamic and Life Cycle Analysis

Bhavik R. Bakshi and L. James Lee

Department of Chemical & Biomolecular Engineering
Ohio State University, Columbus, OH, 43210

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Objectives

- Develop new
 - data,
 - tools and
 - techniquesfor evaluating the
 - life cycle environmental and
 - economic aspects of nanomanufacturingto encourage sensible engineering decisions and policy
- Specific goals
 - Develop life cycle inventory data of nanomanufacturing
 - Perform LCA of nano and traditional processes and products
 - Account for uncertainties
 - Perform Thermodynamic LCA and test hypotheses for evaluating life cycle impact with limited information

Methods

- ❑ Obtain nanomanufacturing data via experimentation and from collaborators
 - Synthesis of nanoclays and carbon nanofibres
 - Preparation of polymer nanocomposite
 - Manufacturing of selected nanoproduct
- ❑ Obtain latest fate, transport, and impact information of emissions from literature and collaborators
- ❑ Life Cycle Analysis of nanomanufacturing
 - Combine data from laboratory, LCA databases, economic models, etc. via multiscale LCA
 - Use data for Thermodynamic LCA
- ❑ Account for uncertainties
- ❑ Test thermodynamics-based hypotheses for evaluating life cycle impact of emerging technologies

Time Frame

Objectives	Year 1	Year 2	Year 3
1) Nanomanufacturing Modules	[Bar spanning Year 1 and Year 2]		
2) Traditional LCA of consumable and durable nanoproducts and alternatives	[Bar spanning Year 1 and Year 2]		
3) Exergy analysis of nanomanufacturing modules	[Bar spanning Year 2 and Year 3]		
4) Thermodynamic LCA of Nanomanufacturing	[Bar spanning Year 2 and Year 3]		
5) Case studies for testing proposed hypotheses	[Bar in Year 1]		[Bar in Year 3]
6) Tool for LCA and economic analysis of polymer nanocomposites			[Bar in Year 3]

Relation to Protecting the Environment and Human Health

- ❑ Identifying and managing risk in research, development and commercialization of nanomanufacturing
- ❑ Preventing irrational optimism or unfounded fear about nanotechnology
- ❑ Balancing harm to the environment and human health with economic feasibility
- ❑ Developing techniques for gaining insight into the life cycle impact of emerging technologies
- ❑ Implementing a tool for LCA and economic analysis of polymer nanocomposites