Waste Powder Paint User Group

Notes on Initial Meeting
April 19, 2011
Objectives for the event

1. Gage the level of interest from the group for continued meetings/activities
2. Identify the focus for a second meeting
3. Decide how future meeting coordination will be accomplished
History of this event

- The problem was brought to our attention by Mr. Bill Gurn of Haworth at a May 5-6 conference of the Green Manufacturing Initiative.
- Further investigation verified that this was a significant problem – outlets for spent powder were limited.
- Mr. Gurn suggested that WMU coordinate an opportunity for a meeting of users to discuss the problem and share experiences.
The Problem

• Lean Manufacturing (Producing to Customer Demand) has confounded one of the benefits of powder paint – the ability to reclaim and reapply

• Frequent color changes lead to:
  – Mixed Colors
  – Mixed Materials (powder technologies)

• Recycling challenges:
  – Degradation of the polymer if re-processed
  – High volume of waste ≠ capacity of outlets
Some Current Outlets

• Small scale research projects, i.e. GMI Composites Inc. (using waste paint in compounding agents for compression molding)
• Innotec Inviromass (molded counterweights) and other green products
• Polyflow process (pyrolysis)
• Plastic Pallet Manufacturing - PF
Proposed Graduate Research at WMU

Powder Paint Blending Research

• The concept will investigate the use of waste powder paint as a filler for injection molding resins.
  – Primarily as a filler for thermoplastic resins.
  – A recycled resin that is useable in standard injection molding equipment.
    • Blended with common use resins.
• Progression of Research
  – Spring 2011-Winter 2011

Evaluation of the types of powder used at facilities
  – Review whether powders are polyesters, epoxy-based, TGIC, etc.
  – Are the waste powder streams mixes of different types of resins? How does this complicate the process?
    – When? Now
• Quality
  – What are the nominal particle sizes? Does particle size vary by resin type?
  – How do metalized powder paints affect the quality?
  – What supply chain quality measures would be necessary?
• Supply Chain
  – Investigating cost factors of transportation of materials.
  – Are networks established currently for such wastes?

Western Michigan University
College of Engineering and Applied Sciences
Manufacturing Research Center
Blending and Chemical Processing

- Development of two phase blends of virgin thermoplastics with powder paint fillers.
  - DSC analysis to determine heating curves.
  - Compatibilizers may be needed or other chemical derivatives in the creation of the composite blend. The use of compatibilizers is common for blending dissimilar polymers together. The purpose of these chemicals is to reduce the interfacial energy between the polymers and thereby improve the adhesive properties of the polymers (17).
  - Study of the rheology of the new resin composites.
  - Determination of base virgin resins.
  - When? Summer 2011

Processing of Test Bars & Mechanical Analysis

- Processing of Test Bars
  - Molding of test composite parts.
- Observing process characteristics of the composite blends.
  - Process pilot size runs with industry products.
- Determining a proper low-temperature base resin.
  - Developing working process profiles.
- Conduct analysis on various material properties of the test bar and evaluate compared to the virgin resin.
  - Tensile Strength
  - Elongation at Break
  - UV & Weatherability
- Last part of research would be the scalability of this project and economics.
- When? Summer & Fall 2011
### Survey Results

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>User's Group Total Surveys Submitted:</td>
<td>6</td>
</tr>
<tr>
<td>Total number of facilities that use powder paint:</td>
<td>11</td>
</tr>
<tr>
<td>Total lbs purchased per year:</td>
<td>3,927,957 (estimated)</td>
</tr>
<tr>
<td>Average cost per lb:</td>
<td>$3.47 (missing data)</td>
</tr>
<tr>
<td>Total disposal cost:</td>
<td>$12,701</td>
</tr>
<tr>
<td>Average disposal cost:</td>
<td>$2,117</td>
</tr>
<tr>
<td>Total waste in lbs per year:</td>
<td>1,454,173</td>
</tr>
<tr>
<td>Average facility transfer efficiency:</td>
<td>63%</td>
</tr>
<tr>
<td>Average waste powder recycled:</td>
<td>18%</td>
</tr>
<tr>
<td>Average waste going to landfill:</td>
<td>68.4%</td>
</tr>
<tr>
<td>Average amount being reclaimed:</td>
<td>11.2%</td>
</tr>
</tbody>
</table>

*Calculated based on group transfer efficiency and waste data*

*Average of 5 respondents*

*Range 50-70% (5 resp.)*

*Range 0 – 50%*

*Range 0 – 100%*

*Range 0 – 30%*
Breakdown on Powder Technologies

Epoxy-Polyester Hybrid:
- Polyesters-Hydroxyl (0%)
- Urethane-Polyesters (4%)
- Polyester Triglycidyl Isocyanurate (TGIC) (2%)
- Epoxy Based (69%)
- 25%
Open Discussion

- What outlets have you investigated?
- What success have you had?
- What outlets would you like investigated?
- Would you be willing to suggest and sponsor university research?

The group openly shared information on previous and current activities focused on finding outlets for this material.
Levels of Engagement

Research

Activities: Experimentation in a lab
Cost: Higher due to a need for dedicated resources – variable depending on project
Projects: Transfer efficiency, development of new equipment, materials and techniques

Inquiry

Activities: Literature reviews, visits to suppliers/manufactures of material and equipment, testing at UG facilities
Cost: Lower (no dedicated resources, part-time grad, under grad and faculty – borrowed lab & equipment)

Networking

“group think”

Activities: Sharing of ideas among UG members and guests
Cost: Very low – facilities and coordination only
Meeting 2 Planning

• Others to Invite:
  – Suppliers
  – Solutions Providers
  – Polymer Experts from Industry
  – Others from academe

• Topics for discussion:
  – Presentations/Proposals from solutions providers
  – Expert overview of the reasons for recycling limitations (Polymer chemists or paint suppliers)
Future Meeting Coordination

• Location: move between large company members (Haworth, Steelcase, Herman Miller)

• Coordination/management – MMTC is willing to commit to this provided that their costs are covered
  – Suggest a tiered “donation” structure with large users covering more of the cost