# **MTRL 466 MEETING MINUTES**

| **Project Name:** | Process Modelling for Adhesive Bonding of Aluminum Automotive Sheet |
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| **Group:** | 1 |
| **Current Meeting:** | Friday October 4th, 2011 |
| **Minutes Prepared By:** | Adam Ohashi |

**Attendees:**

*Dr. Chad Sinclair*

*GROUP 1: Jerry Chang, Michael Fu, Judy Makmillen, Adam Ohashi*

**Agenda:**

* **Gantt chart / timeline review:**
  + Gantt chart for last 3 weeks completed/posted to Wiki

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* **Heat transfer model – Next Step:**
  + Validation of model
    - Heating profile; semi-infinite slab, constant surface temperature
  + Heat values obtained from curing model integrated
  + Heating orientation? (1 side vs. both sides)
* **Coupling models:**
  + Judy managing the combining of all 4 models into one Excel workbook
    - Any issues with lack of sufficient memory?
      * Possibility of creating code to execute calculations
* **Optimization:**
  + Constraints:
    - Curing: approx.
    - Softening: approx.
    - Hardening: approx.
  + Waiting on coupled model to produce output values before determining optimal values of T, t, h
    - Smallest time that meets all process constraints
* **Economic Analysis:**
  + To start this weekend:
    - Determine costs associated with paint baking, energy/operating costs
    - Capital required for an annealing booth, paint station, etc.x
      * Can use contacts from local companies for pricing
    - Begin developing a new processing facility (large scale)

**Minutes:**

Meeting start time: 1:40pm

Meeting end time: 3:20pm

* Midterm report review - aspects to look out for:
  + Referencing
    - Consistency
    - Lack of proper references
  + Repetition of facts
  + Flow from paragraph to paragraph
    - Make sure sub-sections connect
    - Have introductions for each section
    - Segregate processing section from models
  + Be specific!
  + Revise constraints and free variables
    - Add thickness, heating conditions, sheet start temp., etc.
  + Revise these aspects and use in final report
* Heat transfer model:
  + Biot number = convection vs. conduction dominance
  + Newtonian heating conditions
  + Value for epoxy conductivity?
  + Validation done! (numerical vs. analytical)
  + Finite difference model
    - Checks boundary conditions (surface)
    - Half of cross-section = 12 nodes
      * 23 nodes in total
    - Small Δx = small Δt
      * small Δt = many time steps, requires more memory
      * Using Python, code our coupled models, have output to a text file
  + Can have different heating methods implemented in code/heat transfer model
    - Turbulent convection on one side, stagnant on other side with no direct heating
    - For now: start with symmetric heating, if time allows we can vary it
  + Furnace temperature, heating coefficient = constant or varying?
* Optimization
  + Arbitrary constraints for α, σ6111, σ5754
    - Find optimal values for these:
      * α ≥ …, 0.85, 0.9, 0.95, …
      * σ6111 ≥ …, 0.85, 0.9, 0.95, …
      * σ5754 ≤ …, 0.95, 0.9, 0.85, …
      * Tepoxy ≤ 200°C
      * Starting oven temp.?
        + Preheat to certain T
      * Painting takes 15 – 45 min
        + Require a proper time window
    - Have checkpoints in Python to stop execution @ points out of constrain range
* Economics
  + 3 steps (strengthening, curing, paint baking) vs. 1 step (all-in-one)
    - In parallel = need same production rate of cars
    - Require energy consumption/car
    - Capital cost, need more 3-in-1 booths to meet production rate
    - Estimate costs, for example: paint booths
      * Make sure characteristics of custom paint booths match what we want
    - Depreciation, recovery of capital
  + Use existing facility
    - When pricing, costs are done, what is the economic benefit of 3-in-1?

**Action Items:**

* Revise midterm report section for use in final report
* Heat transfer model:
  + Find epoxy conductivity
  + Decide on heating conditions
* Decide on optimization constraints based on model output
* Initialize process economics
  + Price custom paint booths
  + Find energy consumption/costs
  + Determine overall benefit of 3-in-1 process
* **Next meeting: Wednesday, November 9th, 2011 @ 1:30pm**