# **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. $α\leq 0.95$
		- Softening: approx. $\frac{∆σ\_{5xxx}}{∆σ\_{5xxx}^{o}}\leq 0.9$
		- Hardening: approx. $\frac{∆σ\_{6xxx}^{peak}-∆σ\_{6xxx}}{∆σ\_{6xxx}^{peak}}\leq 0.9$
	+ 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**