# **MTRL 466 MEETING MINUTES**

| **Project Name:** | Process Modelling for Adhesive Bonding of Aluminum Automotive Sheet |
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| **Group:** | 1 |
| **Current Meeting:** | Wednesday, October 19, 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:**
	+ Need to prepare Gantt chart for last half of the term
		- All modes need to have completed validation
		- Determine when our models can be coupled
		- Determine how to “calculate” efficiency of our combined processes
		- Complete economic analysis
		- Final report/presentation
* **Heat transfer model – Next Step:**
	+ Confirm appropriate values for epoxy
		- Can use adhesive model’s heating value to determine heat from epoxy
	+ Complete validation used to justify parameters/data for numerical model
		- Determination of Δx
	+ Find conductivity dependence on composition
	+ Heating orientation (1 side vs. both sides)
	+ From Chad: “The next step we have to do is to compare the numerical model against an analytical solution for heat transfer where we have temperature gradients inside the aluminum.”
* **Recovery model – Next Step:**
	+ Find data for lower temperature testing (140C – 200C)
		- Can use this data to:
			* Find pre-strain dependence of model
			* Find relation between activation volume and temperature
	+ From Chad: “How do you determine whether you have the "best" values for U0 and V?”
* **Precipitation model – Next Step:**
	+ Create a 5%-95% confidence interval for the Avrami equ. to account for stress drop (from previous meeting)
* **Adhesive model – Next Step:**
	+ Provide the heat transfer model with heat transfer data for epoxy
	+ Progress on sensitivity testing
* **Economic Analysis:**
	+ What sort of economic analysis do we want to complete?
		- Do we want to follow one similar to Dreisinger’s groups? (large-scale analysis)

**Minutes:**

Meeting start time: 2:10pm

Meeting end time: 3:10pm

* Heat transfer model
	+ Consider thickness of aluminum plates/ epoxy
		- Newtonian range is approximately 1 cm thickness
		- Thickness should not be critically important in outcome of model
	+ Further validation
		- Heating profile; semi-infinite slab, constant surface temperature
* Coupling the models
	+ Combine heat transfer, recovery, recrystallization and curing into one spreadsheet
	+ Link all related cells (ie.: time, temperature, epoxy heat generation)
	+ Use one spreadsheet per node?
* Optimization of Process
	+ Curing: approx. 95% cured = mechanically sound
		- Constraint: $α\leq 0.95$
	+ Softening: approx. $\frac{∆σ\_{5xxx}}{∆σ\_{5xxx}^{o}}\leq 0.9$
	+ Hardening: approx. $\frac{∆σ\_{6xxx}^{peak}-∆σ\_{6xxx}}{∆σ\_{6xxx}^{peak}}\leq 0.9$
	+ Graphically present optimal values
		- Temperature vs. heat transfer coefficient plot
		- Series of curves for each part of model (curing, softening, hardening), all values of (T,h) above the curves meet conditions and are considered valid
			* Time is implicit
		- Choose the limiting point on plot at the smallest time, find cost relationship to time
* Economic Analysis
	+ Determine costs associated with paint baking, energy/operating costs
		- Capital required for an annealing booth, paint station, etc.
			* Can use contacts from local companies for pricing
	+ Develop a new processing facility (large scale)

**Action Items:**

* Extend the Gantt chart to cover the remaining 3 weeks until final presentations/report
* Heat transfer model validation
* Have heat of curing added to heat transfer model
* Couple the models
* Analyze process optimization with constraints
* Quantify the economics of our process
* **Next meeting: Friday, November 4th, 2011 @ 1:30pm**