Center for Lightweighting Automotive Materials and Processing

Prof. P. K. Mallick

University of Michigan-Dearborn

Dearborn, MI 48128

(This presentation does not contain any proprietary or confidential information.)

CLAMP

GATE
GRADUATE AUTOMOTIVE TECHNOLOGY EDUCATION

CLAMP Purpose of Work

- To create a university/industry/government collaborative education/research/information center on automotive materials and processing for lightweight automobiles
- Emphasis is on graduate education, research and knowledge transfer to future engineers and researchers

CLAMP Barriers Addressed

- Improvement in energy efficiency and environmental impact will require significant mass reduction and much more efficient use of materials for future automobiles.
- Materials and processing development, and innovative adaptation of advanced technology are needed for mass reduction and lightweight structures.
- Many university curricula and research do not address the advanced materials and processing technology used and/or developed for the automotive industry.

CLAMP Approach

- Establish automotive materials concentration in the existing master's program on Automotive Systems Engineering
- Conduct research on automotive materials and processing
- Establish an automotive materials database
- Conduct seminars/colloquia/continuing education courses for practicing engineers on automotive materials

CLAMP Statistics: 2007

- No. of students in materials classes offered in the ASE program: 47
- No. of graduate students in CLAMP research: 10
- No. of undergraduate students in CLAMP research: 4
- No. of post-doctoral fellows: 1
- No. of faculty: 6
- No. of research projects: 11
- No. of CLAMP supported research: 5
- No. of industry funded research: 4

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Automotive Systems Engineering

- Courses Developed/Taught in 2007-2008
  - Materials Selection in Automotive Design (AE 581)
  - Design and Manufacturing for Environment (AE 588)
  - Designing and Manufacturing with Lightweight Automotive Materials (AE 586)

CLAMP Research: 2007

Project Title	Sponsor
Development of Thermoplastic Matrix Composites using Resin Infusion	CLAMP
Fatigue of Automotive Thermoplastics	CLAMP
Development of Crush-Resistant Aluminum/Composite Hybrid Tubes and Plates	CLAMP
Processing and Characterization of Novel Lightweight Multifunctional Hybrid Structures	UM-OVPR

CLAMP Research: 2007

Project Title	Sponsor
Joining of Magnesium to Magnesium and other Materials	CLAMP
Development of CAE Tools and Design Guidelines for Advanced Superplastic Forming	Ford Motor Co.
Effect of Pretreatment on the Adhesive Joining of Magnesium Alloys	USAMP
Fatigue Performance of Fusion Welded Joints in High Strength Steels	Auto-Steel Partnership
Corrosion of Creep-Resistant Magnesium Alloys in Aqueous Solutions and Engine Coolants	USAMP
Formability of Aluminum Tubes using Tube Flaring Tests	CLAMP
Numerical Simulation of Spot Friction Welding Process of Magnesium Alloys	UM-OVPR

CLAMP Materials Information

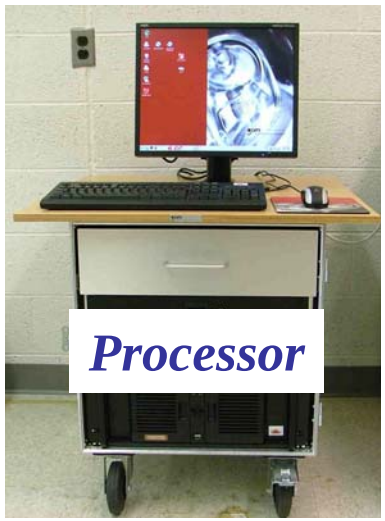
- Information on structural automotive materials
- Gather, store and disseminate archival and encyclopedic information on structural automotive materials
- Database on properties, processing, test methods and application examples
- Internet access to industry, universities and individuals

CLAMP Symposium/Workshop/Conference

- Held a one-day workshop on Fuel Cell Materials and Manufacturing on June 20, 2007
  - Topics: Examples
    - Fuel Cell Technology toward Commercial Viability
    - Automotive Fuel Cells: Path to Commercialization
    - Fuel Cell Manufacturing R & D at Rensselaer
    - SOFC Interconnect Research at NETL
  - Speakers were from Ford, GM, NETL, RPI, Ovonic, NCMS, etc.
  - Participants: About 100 participants from industry, university and government labs.

CLAMP Laboratory Upgrading

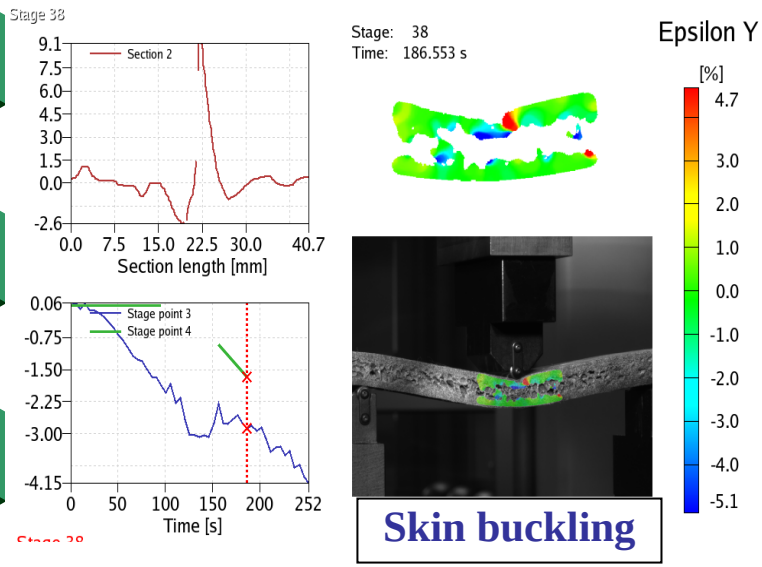
High-Speed, High Resolution Non-Contact Strain Measurement System (Funded by NSF)

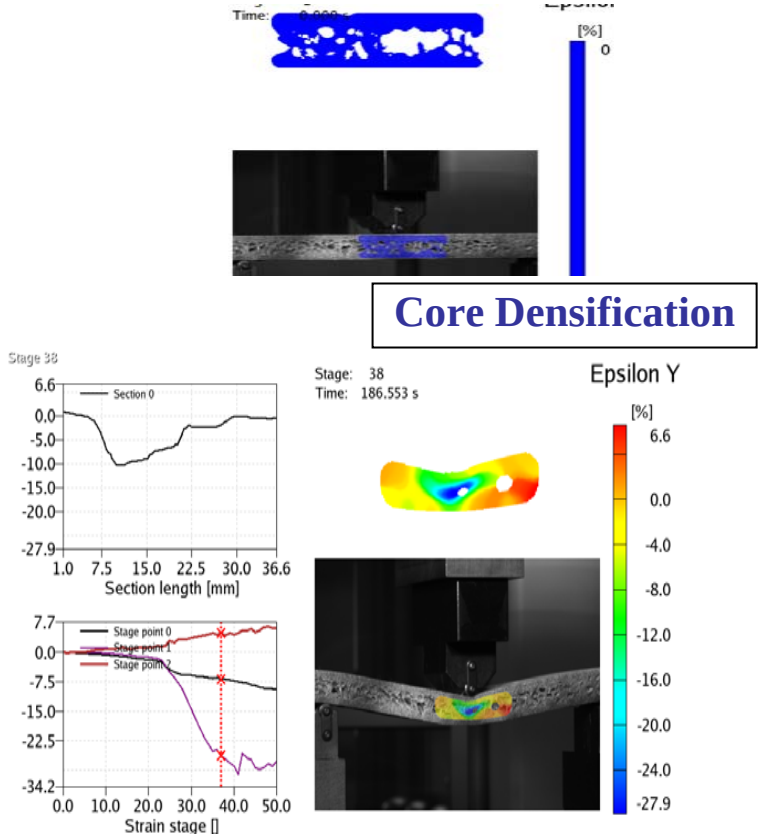


Quasi static cameras (10 fps)

High speed cameras (100,000 fps)

CLAMP Non-Contact Strain Measurement





Woven Composite Skin-Aluminum Foam Core Sandwich Structures

Publications by CLAMP Faculty and Students: 2007

- No. of Refereed Journal Publications: 9
- No. of Conference Publications: 10
- No. of Books: 1

CLAMP Snapshot of Publications

- Fatigue of Advanced High Strength Steel Spot Welds (SAE Trans., J. Matls. & Manuf.]
- Spot Friction Welding of Wrought Magnesium (TMS)
- Development of Accurate Constitutive Models for Simulation of Superplastic Forming (J. Matls. Engg. & Performnce)
- Mechanical Behavior of Lightweight Thermoplastic Fiber-Metal Laminates (J. Matls. Processing Tech.)

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Plans for Next Year

- Develop a new graduate course
- Initiate new research
- Laboratory upgrading
  - Mechanical Testing Laboratory [on-going]
  - Corrosion Laboratory [on-going]
  - Materials Forming Laboratory
- Material Database Updating [on-going]
- The 2nd Symposium on Lightweight Automotive Materials and Processing [the 1st Symposium was held in 2003]

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Automotive Systems Engineering

- Courses planned for teaching in 2008-2009
  - Fuel Cell Materials and Manufacturing (AE 590)
  - Composite Materials (ME 589)
  - Mechanical Behavior of Polymers (ME 584)
- Courses to be developed in 2008
  - Materials and Design for Crashworthiness of Automobiles

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New Research: 2008

- Modeling of Composite Pressure Vessels for Hydrogen Storage
- Effect of Bio-Fuels on the Long Term Performance of Polymers used in Fuel Containment and Delivery Systems
- Development of Thermally Conductive Composites for Lightweight Heat Exchangers
- Fatigue Performance of Laser Welded Joints in Sheet Steels

CLAMP

- Increase collaborative research with industry
- Recruit more full time graduate students
- Add more courses to our distance learning programs
- Explore collaboration with other universities

CLAMP

- Acknowledgement
  - Department of Energy
  - College of Engineering and Computer Science
  - Industry Collaborators
  - Graduate Students in the Program

Thank You…