**MULTI-MATERIAL JOINING**

There is a need to join dissimilar materials together in a quick, easy and mechanically sound manner. The multi-material joining project is an ongoing project that seeks to understand new joining technologies for binding different metals together. The objective of the multi-material joining project is to fully understand these binding methods and how they will affect long-term performance of dissimilar materials.

**THE TECHNOLOGY**

The multi-material joining project evaluates strength, adhesion and corrosion of dissimilar materials at mechanical joints in order to maximize long-term performance in industrial applications. The project is designed to investigate many different configurations of joining technologies and different material applications. OSU has the unique capability to evaluate corrosion on several levels, including:

- Accelerated laboratory testing
- On-vehicle evaluation – accelerated and real-time
- Modeling & Simulation of both the joining process and mechanical behavior

This capability yields the ability to develop both short term strength models and long term structural models, such as durability (fatigue) and corrosion that can predict joint performance. Each joint will undergo extensive strength (low and high strain rate) and fatigue studies. These evaluations provide the basis for kinematic models that allow us to generate standards around joint architecture of dissimilar materials, including number of joints required and proper joint placement. These results will be used to develop simulation templates to guide virtual prototyping studies, allowing for strength, fatigue and crash-worthiness.

Initial tests focus on tack joint technology, primarily using ridged nails. In this process, a nail is driven through multiple layers of material creating a joint that can be as strong as resistance spot weld (RSW). An adhesive layer is used in conjunction with the nail to improve joint strength. The insertion process creates a consistent bond line for the adhesive, providing an ideal environment for the adhesive joint.

**PROJECT GOALS**

A full understanding of each joint evaluated, including:

- Corrosion response and predictive tool development
- Strength (high and low strain rate)
- Predictive fatigue life
- Exploring a wide range of numerical methods for simulating process and performance (Implicit & Explicit FEA, SPH, ALE)
- FEA Element for predictive solid modeling Kinematic model for joint development
- Building Knowledge based Advisors to guide Design Engineers and Joining Process Planners.

**KEY FEATURES AND BENEFITS**

- Corrosion studies can increase durability of joined materials
- Adhesive layer testing increases stability and strength of the joint
- Understanding corrosion at the joint site can enhance safety of the application
- Corrosion studies can lengthen lifetime of joining technologies
- Expanded options for joining dissimilar materials become available

**MARKET OPPORTUNITIES**

Manufacturing and industrial applications:

- Aircraft
- Appliance
- Sheet metal products
- Automotive
HOW TO JOIN

This multi-industry project is intended to continuously evolve as new material combinations, applications and joining technologies enter into the marketplace. The program will be executed and managed by CDME, which performs engineering and manufacturing services for industry partners.

Interested industrial sponsors may join this program for a minimum price of $50,000, renewable each year based on the needs of the sponsor. Industry sponsors will have the ability to provide input into the work being performed that year, receive a monthly report detailing the program progress, participate in bi-monthly industry meetings, and receive the yearly edition of the technical report. The price for direct work will be negotiated on a case-by-case basis. Each year, the project team and current sponsors will set new targets for the work to be completed in the subsequent year.

CONTACTS

CDME
1314 Kinnear Road, Columbus OH, 43212
614-292-6570 • cdme.osu.edu

John Bockbrader, Project Manager
bockbrader.2@osu.edu

Charlie Young, Director of Business Development
young.2631@osu.edu