Reversible Adhesive System To Improve Both Maintenance And Sustainment

Brian Kornish

PPG Industries, Inc.

Problem Statement

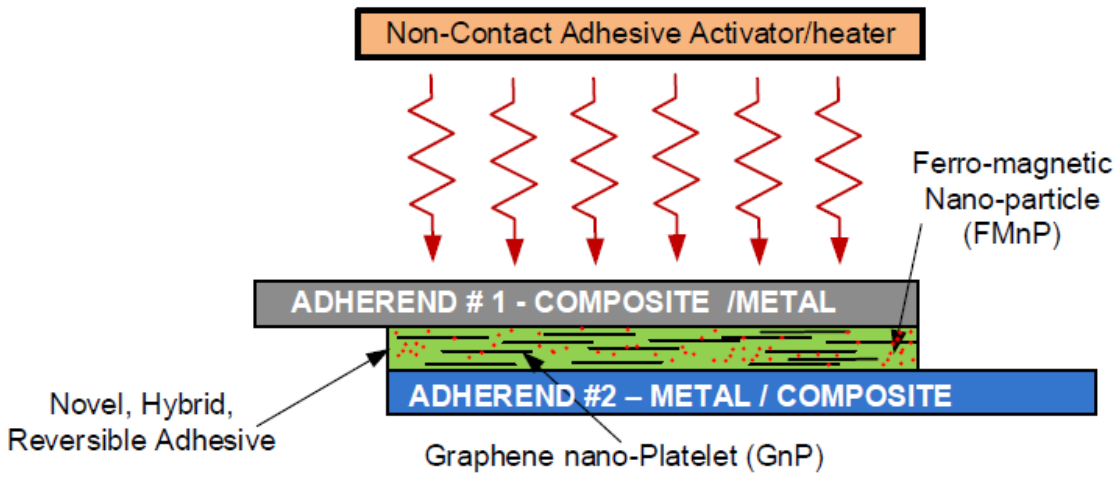
- Joining dissimilar materials creates new technical challenges for maintenance, including robust joining techniques, new modes of corrosion prevention, and repair solutions
- Conventional structural adhesives are thermoset and can only be cured once
- These adhesives cannot be reversed so that parts can be disassembled, repaired, or easily recycled, thus increasing maintenance and sustainment time/effort/costs

Technical Approach

- As an alternative, thermoplastic adhesives provide a means to reversibly adhere vehicle components
- The thermoplastic adhesive challenge is that the material must survive the temperatures of the manufacturing process and day to day use, and then be easily undone when desired
- Michigan State University has been conducting thermoplastic adhesive research using conductive nanoparticles to assemble and disassemble joints on demand

Technical Approach

- Thermoplastic adhesives reinforced with graphene nanoplatelets and ferromagnetic nanoparticles will be used to evaluate the **reversible bonding** behavior for a combination of steel, aluminum, and glass-fiber reinforced composite substrates



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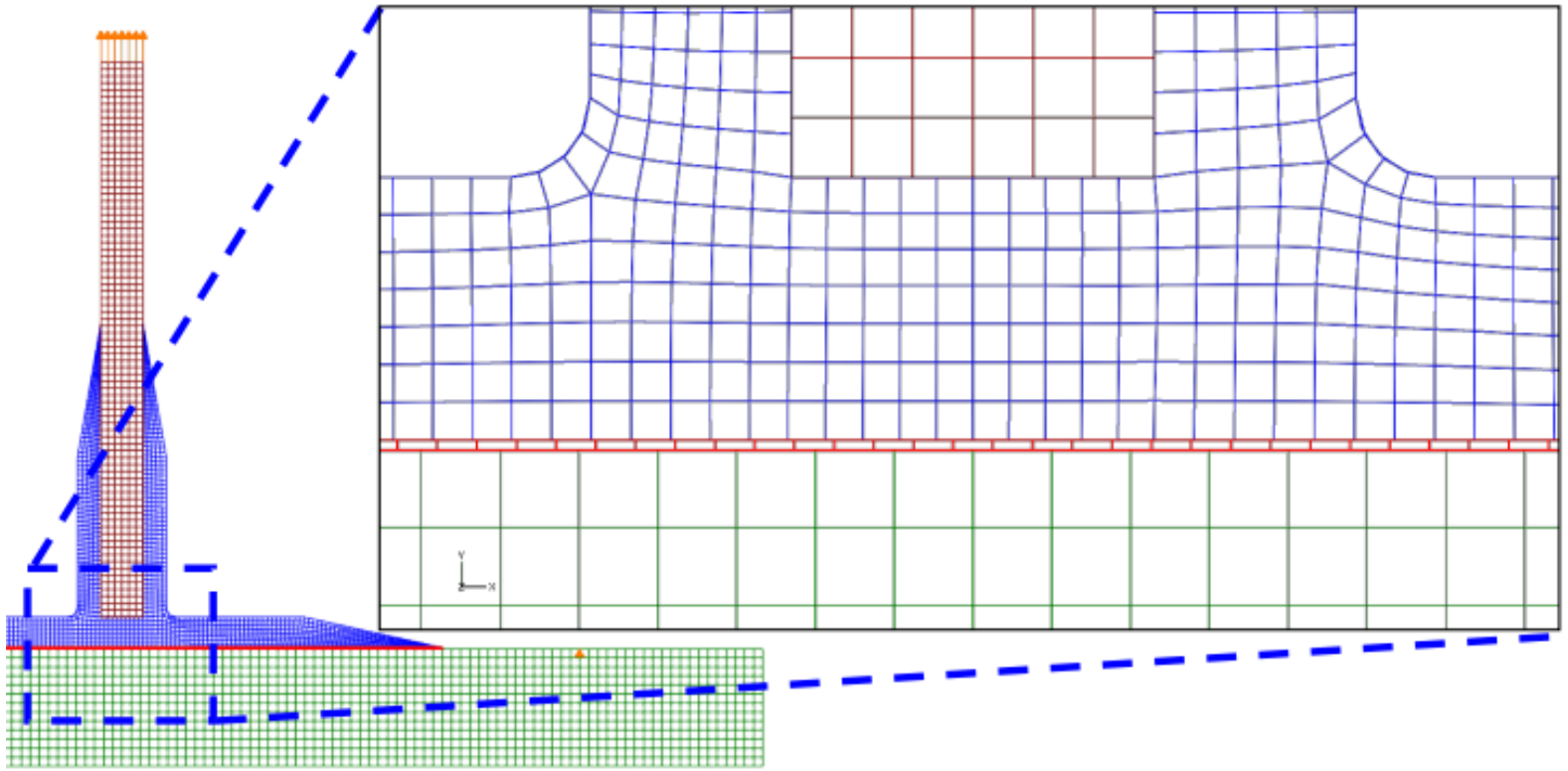
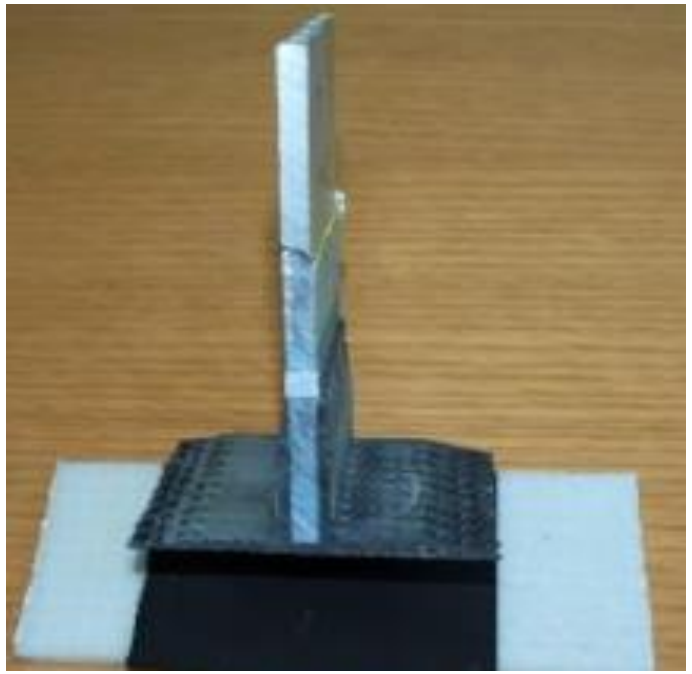
MSU Modeling/Simulation and Prototype





Overall Benefits

- Increase in fuel efficiency due to the lighter weight
- Faster and easier repairs of composite vehicles and perhaps aircraft
- Improvements in automotive repair for new materials and potential for composite part recycling

Technology Deployment

Task	Description	Status
1	Adhesive material selection and characterization, including PPG materials	Kickoff pending
2	Additive material evaluation FMNP and GnP	
3	Lab-scale joint evaluation	Later this year
4	Activation system development	Next year
5	Joint demonstration and commercialization evaluation	

Project Team Participants

- US Army TARDEC – Product Life Cycle Engineering
- Michigan State University
- PPG Industries, Inc.