Material Qualification in the Automotive Industry

June 13, 2017

Rubber In Automotive Conference
The Center for Automotive Research (CAR)

Automotive industry contract research and service organization (non-profit) with more than 30 years experience forecasting industry trends, advising on public policy, and sponsoring multi-stakeholder communication forums.

• CAR conducts leading edge **Research** that impacts the future of the global automotive industry.

• CAR **Events and Conferences** that engage industry leaders and provide forums for industry leaders to discuss critical topics, offer solutions.

• CAR **Consortia** bring together automotive manufacturers and suppliers, consultancies and government agencies to participate in working groups, networking opportunities, access to CAR staff and research.
IT IS COMPLICATED, AND IT WILL GET MORE COMPLICATED
Major Changes Will Bring More Opportunities

- Regulatory Policies and OEM Perspectives
  - Fuel Economy
  - Credits
  - Lightweighting Cost

- Materials and Manufacturing Technologies
  - Lightweighting Trends
  - New Manufacturing Technologies

- Powertrain Technologies
  - IC
  - Electric
  - Fuel Cell

- Connected and Automated Vehicle
  - Technologies
  - New Business Models
All the Major Economies Have Emission Reduction Goals
Material Technology in Future Vehicles

Material Percentage Use by Year, 2010 to 2040

- Mild Steel
- HSLA: High Strength Low Alloy
- HSS: High Strength Steel
- AHSS: Advanced High Strength Steel
- UHSS: Ultra High Strength Steel
- Boron/Martensite
- AL 5000/6000: Aluminum 5000/6000
- Aluminum/High Strength
- Mg: Magnesium
- CFRP/Comp.: Carbon Fiber Reinforced Plastic/Composites

Electric vehicles more popular globally compared to North America

Source: CAR Research; USEPA/NHTSA Technical Assessment Report; Global EV Outlook 2016; International Energy Agency; Joining Forces to Tackle Road Transport CO2 Challenge, European Automobile Manufacturers Association; various others
Note: It is currently unclear whether automotive manufacturers will market vehicles with Level 3 capabilities, because of significant human-machine interaction issues. It is too soon to predict whether it will be possible to produce Level 5 vehicles, capable of operating anywhere and in all situations.

Source: CAR Research
Taking New Products from Supplier to Customer?
Material Qualification

- Material qualification is a process that takes place between a material supplier and the customer (usually an automaker for tier 1 suppliers).

- The objective is to make sure that the materials meet the requirements set by the customer.

- The qualification process involves a series of iterative steps until the customer approves the supplier’s material to be considered in its future products.
Material Development → Material Qualification → Validation
Question OEMs Ask

• Which vehicle component is the material for?
  – Is the material for a safety critical or structural application on a vehicle?
• How different is the material from the current materials used?
  – Is the material new and requires full analysis and characterization, plus new computation tools?
• Which part of the world and under what conditions the vehicle will be used?
  – Will the vehicle be used in harsh environments?
• Does the OEM have a past relationship with the supplier?
  – Are there any past negative incidents? Do a SWOT
• Is there an existing product in the market using the material?
• Is the supply chain for the material robust?
  – Are there multiple global sources of the material or product available?
• Are there any end-of-life considerations and regulations?
• Is compatibility with other adjoining materials in terms of joining, corrosion etc. an issue?
• Does the company has workforce skills and experience in working with the material?
  – What are OEM’s current capability of manufacturing equipment? Is it constrained to specific materials?
  – Does the product or material involves high capital investment?
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Major Issues

- It is often difficult for OEMs to be specific because they may not be completely familiar with the capabilities of a given supplier.
- Every OEM has different requirements for material specifications or properties needed for qualification.
- Vehicle Development Plans (VDP) are very tightly scheduled and allows only a few days to make decisions over materials to be used for the parts in question.
- The auto industry lacks reliable material models needed to digitally test vehicle components made from newer lightweight material substitutes.
- Leadership approval can be the tipping point in the process of material qualification.
Material Suppliers Versus OEMs Viewpoints

**Material suppliers** are in general **more optimistic** about the near future applications of the new advanced materials than the OEMs.
Material Suppliers Versus OEMs Viewpoints

Car companies can only deal with incremental improvements in material technology. There are several **risks involved with revolutionary materials:**

- **Risk of part failure and vehicle recall**
- **Failing supply chain**
- **End-of-life recycling and Environmental Concerns**
- **Cost versus benefit**
- **Customer expectation**

63.95 million vehicles recalled in 2014 (NHTSA)
$2 million to $35 million cost per recall for US companies (IHS)
Workforce Issues

• Private & public spending on job training is not growing; hours of training/year remain flat

• Aging Workforce: One-third of motor vehicle & parts employees currently are or will soon be eligible to retire

• Mechanical Engineers not taught chemistry

An aging workforce
Recommendations

• Collaborative efforts and open innovation challenges
  – Standardization of testing requirements
  – Breaking the cultural barriers

• Better communication and workforce training
  – Too much information for engineers to digest. How to effectively use big data
  – Third of all engineering work is just duplicated
  – Sharing of information should be increased between departments. R&D investment for developing reliable simulation tools

• R&D investment for developing advanced forming and joining technologies

• Harmonization of OEM standards for material qualifications
When the natural rubber supply from Southeast Asia was cut off at the beginning of World War II, the United States and its allies faced the loss of a strategic material. There was a real danger the war would be lost unless American scientists and technologists were able to replace almost a million tons of natural rubber with a synthetic substitute within 18 months.

With U.S. government sponsorship, a consortium of companies involved in rubber research and production developed and manufactured in record time enough synthetic rubber to meet the needs of the U.S. and its allies during World War II.

The partnership expanded the U.S. synthetic rubber industry from an annual output of 231 tons of general purpose rubber in 1941 to an output of 70,000 tons a month in 1945.
THANK YOU

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