Materials Engineering

Materials Engineering Sessions focus on the areas of properties, selection, processing and performance of materials.

M102 Advances in Lightweight Materials
This session presents the latest developments in automotive applications of wrought products. The papers cover a wide range of the technical aspects including alloy development, lightweight design, process development and simulation as well as performance optimization.

M104 Applications of Advanced High-Strength Steels and Press Hardening for Automotive Structures
This session provides a forum for researchers and application engineers to disseminate the knowledge and information gained in the area of advanced high-strength and press-hardening steel development and applications in automotive structures, enabling light-weight and durable vehicles with improved safety.

M105 Sheet Metal Forming Technology
This session will feature the latest developments in sheet metal forming technology. Presentations will address general areas of forming processes, formability issues and modeling. These include forming processes (Stamping, hydroforming, gas forming, high temperature forming), formability Issues (springback, edge cracking, stretch-bend failures and fracture), Modeling (materials, forming limits, failure criteria in various deformation modes and process modeling & optimization).

M106 Advances in Metalcasting
Metalcasting is one of the oldest manufacturing processes, dating back over five millennia. However, recent advances continue to expand the horizons of metalcasting: new alloys and new casting techniques are leading to enhanced properties, process modeling and simulation tools are enabling better casting designs, the increasing use of metal-matrix composites is opening new frontiers in casting performance, and additive manufacturing techniques such as 3D printing of pattern materials are reducing lead times for prototype castings. This session will cover the latest developments in ferrous and non-ferrous metalcasting technologies for the mobility industry.

M107 Failure Analysis of Materials, Components, and Systems
The mobility industry is constantly challenged to provide customers with the ultimate in reliability and durability. As a result, when failures occur during testing or real-world service, it is essential to identify the root cause and take appropriate corrective action in a timely manner. Understanding and learning from failures is critical to product success. This session will cover failure analysis methodology, creative

problem-solving, fundamentals of failure mechanisms, non-destructive evaluation, fractography, and case examples of failure analysis and prevention.

M200 Fatigue Modeling / Testing & CAE Durability Analysis
Focuses on innovative and improved fatigue methodologies and problem-solving techniques on automotive components, assemblies and vehicles based on material characterization, testing and CAE (Computer Aided Engineering) analysis.

M202 Advanced Analysis, Design, and Optimization of Materials, Restraints, and Structures for Enhanced Automotive Safety and Weight Reduction
Papers with an emphasis on, but not limited to, innovative ideas to enhance automotive safety with improved material constitutive modeling, analysis method developments, simulation and pre/post processing tools, optimization techniques, crash code developments, finite element model updating, model validation and verification techniques, dummies and occupants, restraint systems, passive safety as well as lightweight material applications and designs are highly encouraged.

M203 Automotive Engineering Testing and Test Methods
The focus of this session are the tests and test methods employed in the evaluation of the performance and durability of powertrain (engines, transmissions), driveline (4WD systems, driveshafts, axles), chassis (frame, suspensions, brakes, etc.) and body components, subsystems, and full vehicle systems.

M204 Optical Measurement and Nondestructive Testing Techniques in Automotive Engineering
Optical based Techniques/technologies for Materials Characterization, Strain/Measurement, Nondestructive Testing, and Validation of Materials Models etc.

M205 Materials and Residual Stress Test Development
Key words: residual stress, retained austenite, x-ray diffraction, neutron diffraction, induction hardening, carburizing, shot peening, quench and template, residual stress simulation, residual stress test

M206 Load Simulation and Vehicle Performance: Nonlinear Components/Systems
Focusing on new theory, formulation and modeling of amplitude-, frequency- and temperature-dependent nonlinear components/systems such as mounts or bushings, shock absorbers, and joint friction/damping; dynamic characterization through lab and field testing; Linearization methodology; Model validation, application, and sensitivity analysis in vehicle system/subsystem simulations; Nonlinear system identification, modeling, and application in testing accuracy improvement, etc.

M207 Load Simulation and Vehicle Performance: Ride Comfort
This session focusing on vehicle ride comfort, addressing issues such as ride evaluation, suspension tuning, occupant biomechanics, seating dynamics, semi-active and active suspension and vehicle elastomeric components. Topics may include vehicle ride motion smoothness and control balancing, structural shake, impact harshness and after shake, brake judder/pulsation, smooth road shake/shimmy/nibble, power hop, launch shudder, freeway hop and any other phenomena affecting ride comfort.

M208 Load Simulation and Vehicle Performance: Tire and Terrain

Focusing on tire and terrain mechanics modeling for load simulations, tire model development, parameters identification, and sensitivity analyses, tire test development, road profile characterization, effective road profile development, and interactions between tire, suspension/steering/brake systems, and different terrains, spindle loads/travel variation characteristics from deterministic and rough roads, terramechanics, tire noise, rolling resistance and correlation studies.

M209 Load Simulation and Vehicle Performance: Multi-body Dynamics and Intelligent Vehicle Dynamics

Multibody system modeling and simulation, rigid and flexible body modeling, loads predictions for vehicle body, frame/sub-frame, exhaust system, driveline, and powertrain, modeling of vehicle dynamics simulation and durability loads simulation, process considering vehicle dynamics and durability loads, data processing and analysis, loads sensitivity analyses for model parameters, design load minimization, prediction of loads effects, robust design methods, driver modeling, and system modeling.

M210 Load Simulation and Vehicle Performance: Handling and Dynamics

This session focuses on analysis and enhancement of vehicle dynamics performance including handling/ braking/ traction characteristics as well as robustness and active stability under the influence of loading, tire forces and intelligent tire technology for enhancing overall vehicle system dynamics and safety characteristics and robustness. Load variations and other uncertainties, impact of system hybridization and electrification on vehicle dynamics and controls will be discussed.

M211 NVH CAE Analysis & Testing Correlations

This session covers the development and application of numerical methods along with test correlation and optimization for NVH issues of full vehicle and vehicle subsystems. All structural components, subsystems and complete systems found in automotive vehicles will be considered. Topics include structure NVH, vibro-acoustics, wind noise and aeroacoustics, intake/exhaust and vehicle interior noise, sound quality etc.

M213 Multi-Discipline Interaction and Special CAE Applications

This session will address recent advances in simulation technologies at scales ranging from theoretical development, real world CAE applications, and future development of the special stress and fatigue analyses techniques. The session is focus on the use of the combination of the dynamic, static, linear and nonlinear Finite Element Method (FEM) methods, Computational Fluid Dynamics (CFD), and Multibody Dynamics (MBD) to evaluate the stress, noise vibration & fatigue performance of the vehicle components and / or cross functional vehicle system.

M214 Automotive Tribology

This technical session focuses on fundamental and applied research that lowers frictional energy losses and enhances reliability and durability of automotive components. The topics include, but not limited to engine and drivetrain tribology, seals, bearing and gear lubrication, materials tribology, surface

engineering, lubricants and additives, computer-aided tribology, tribotesting, as well as friction, wear and lubrication fundamentals.

M215 Composite Modeling/ Testing and Analysis Technology
This session focuses on state-of-art theory and methodology development in physical testing and virtual simulation of composite material properties and structure behavior during manufacture process and under different environmental and loading conditions in automotive industry.

M216 Welding and Joining and Fastening
Presentations related to welding and joining of similar or dissimilar materials of plastics, composites, aluminum, magnesium, titanium, and conventional and advanced high strength steels will be given. Papers related to friction stir (spot) welding, ultrasonic welding, resistance welding, arc welding, laser welding, brazing or soldering, riveting and bolting, and adhesive are planned as well.   Papers related to strength, fracture and fatigue of welds, joints and fasteners have been invited.

M217 Materials-Environment Interactions
Corrosion, oxidation, erosion, corrosion-fatigue, stress-corrosion cracking, wear, etc. These issues in aluminum and magnesium are immediate challenges to the development of lightweight materials. Modeling, simulation, testing, diagnosis, and mitigation related to these issues are all challenging and fascinating.

M300 Automotive Polymeric, Plastic Components and Composites
Presentations of this session will address the development of polymeric and composite materials for automotive interiors and exteriors, powertrain components, as well as structural and non-structural applications. Focus is on design, processes, bonding and manufacturing technologies, as well as lightweighting strategies.

M301 Advances in Instrument Panels, Seats, and Interiors
This session will feature technical presentations that will discuss new technology and industry insights in automotive interiors. Focus areas include materials, perceived quality, environmental concerns, manufacturing, safety, and durability.

M302 Automotive Composites Structures
This session contains papers which describe the use of modern automotive composites in structural applications. Design, process, and analytical presentations are included, as well as papers presenting results of bonding strategies and techniques. Engineers involved in the design and use of advanced composites will find this session of particular value.

M400 Advances in Coatings
Presentations of this session will address application and research on coatings for exterior body and plastics (including polycarbonate) as well as vehicle interiors and underbody/underhood. Focus will be on the 3-10 year timeframe.

M401 UV/EB Leading the Way for the Future of Automotive

Success in cure technology attained through advances photocurable materials, UV Laser technology, lamp development, 3D computer imaging, and the development of novel materials, processes and facilities, are significantly advancing the efforts of energy reduction and vehicle lightweighting resulting in improvements of reduced GHG emissions, manufacturing Cycle Time, Small Footprint manufacturing, speedy proto-type development and Additive Manufacturing, all creating a revolution in manufacturing.