

SAE 2011 Light-Duty Diesel Emissions Control Symposium

November 2-3, 2011

**Ann Arbor Marriott Ypsilanti at Eagle Crest
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EVENT OVERVIEW

Emergency Hotline
1-800-581-9295

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 Troy, MI 48084
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 Fax: 1-248-273-2494

Tuesday November 23	Wednesday November 3	Thursday November 4
	Registration 7:30 a.m. – 5:00 p.m.	Registration 7:30 a.m. – 2:00 p.m.
	Continental Breakfast / Networking 8:30 – 9:00 a.m.	Continental Breakfast / Networking 8:30 – 9:00 a.m.
	Technical Sessions 9:00 a.m. – 5:30 p.m.	Technical Sessions 9:00 a.m. – 3:30 p.m.
	Morning Break 10:30 – 11:00 a.m.	Morning Break 10:30 – 11:00 a.m.
Exhibit Set-Up 3:00 p.m.	Lunch 12:30 – 2:30 p.m.	Lunch 12:30 – 2:00 p.m.
Registration Hours 3:00 – 6:00 p.m.	Afternoon Break 3:30 – 4:00 p.m.	Wrap Up and Closing 3:30 p.m.
Networking Reception 6:00 – 7:00 p.m.	Networking Reception 5:30 – 6:30 p.m. Sponsored by:    Johnson Matthey Catalysts	

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SYMPOSIUM ORGANIZERS

Phil is Technical Director for Research and Development, ECT North America, in charge of all activities supporting mobile emission control catalyst development for the North American market. After receiving his PhD in Chemistry from Imperial College, London, Phil joined Johnson Matthey 13 years ago as a Diesel Catalyst Development Chemist, which developed into a management role at the European Technical Center in Royston, UK. Subsequently, Phil moved to Asia and was responsible for managing the technology activities for diesel customers in the Chinese and Korean markets, before moving to his current position in 2010. Phil is co-author of a number of publications and patents in the area of mobile emissions control.



Phil Blakeman

Technical Director,
Johnson Matthey Inc

Neal Currier is currently the senior scientist in the Catalyst Technology and Emissions Chemistry Department at Cummins Inc. He has three decades of industrial research experience in various industries. His work has resulted in 23 publications in peer-reviewed journals, numerous oral presentations, two issued and several pending patents. Mr. Currier received his Bachelors in Chemistry and Mathematics from St. Olaf College. He joined Cummins Inc. in 1992. Since that time he has been responsible for developing and executing Cummins' research portfolio in the area of NOx adsorbers specifically and exhaust emissions reduction catalysis in general, including initiating and leading several academic collaborations and CRADAs with national laboratories.



Neal Currier

Senior Scientist,
Catalyst Technology &
Emissions Chemistry
Department, Cummins Inc.

Uwe Zink is based in Corning, NY and Director, Emerging Industry Technology, focusing on LD & HD drive train and vehicle trends and implication for Corning. Prior to his current position, he started in Wiesbaden, Germany as Application Engineer for catalytic converter substrates servicing the European automotive industry. He held various roles in Application and Systems Engineering, Applied Technology Management, Program Management, Technical Market Development in Europe and in the US, dealing with and in regional and global gasoline and diesel light duty, heavy duty, and off-road markets. His responsibilities also included representation of Corning within industry associations. He is past Chairman of SAE ComVec Drivetrain/Powertrain Committee.



Uwe Zink

Director, Emerging
Industry Technology,
Corning Inc.

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On-Site Registration

Pre Function A

Tuesday, November 1

3:00 – 6:00 p.m.

Wednesday, November 2

7:30 a.m. – 5:00 p.m.

Thursday, November 3

7:30 a.m. – 2:00 p.m.

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Networking Opportunities

Pre Function A and Salon I

Tuesday, November 1

Networking Reception

6:00 – 7:00 p.m.

Wednesday, November 2

Breakfast

8:30 – 9:00 a.m.

Morning Break

10:30 – 11:00 a.m.

Lunch

12:30 – 2:30 p.m.

Afternoon Break

3:30 – 4:00 p.m.

Networking Reception

5:30 – 6:30 p.m.

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Thursday, November 3

Breakfast

8:30 – 9:00 a.m.

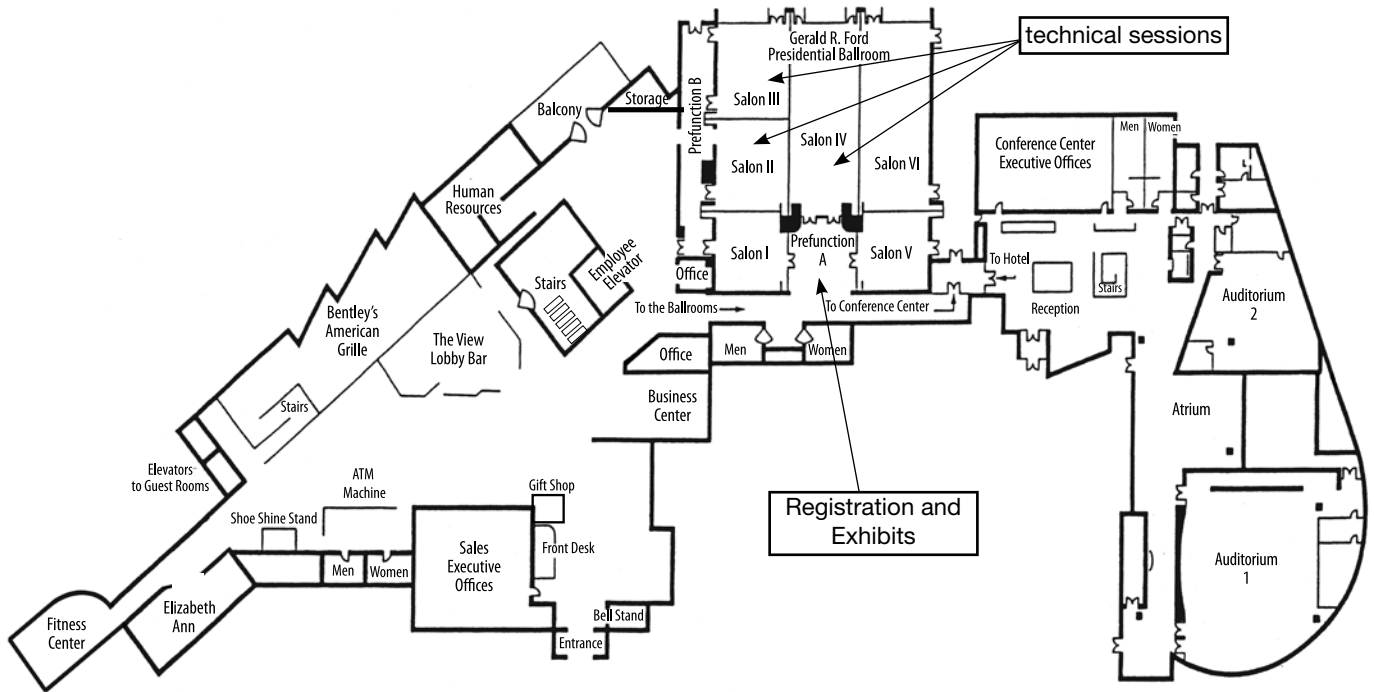
Morning Break

10:30 – 11:00 a.m.

Lunch

12:30 – 2:00 p.m.

HOTEL FLOOR PLAN



TECHNICAL PROGRAM

WEDNESDAY

November 2

Salons II, III, IV

(Speaker bios/photos begin in order of appearance on page 9)

7:30 a.m.

SAE Registration Opens

8:30 a.m.

Continental Breakfast / Networking

8:45 a.m.

Welcome & Announcements

Melissa Jena, SAE International

Legislation - Chair: Phil Blakeman, Johnson Matthey

9:00 a.m.

Global Regulatory Trends for Light-Duty Diesel Vehicles

Joseph Kubsh, MECA

9:30 a.m.

Emerging Trends in Light-Duty Emission Control and Efficiency

Tim Johnson, Corning

10:00 a.m.

Panel Discussion

10:30 a.m.

Break

PM Filters - Chair: Neal Currier, Cummins

11:00 a.m.

Light Duty Filters

Jason Warkins, Achim Heibel, Sam George, Nancy Golomb, Christopher Warren, Corning Inc.

11:20 a.m.

Advanced Substrate and DPF Technologies for Diesel NOx Emission Systems

Paul Busch, NGK

11:40 a.m.

Diesel Particulate Filter Development over the last 10 year - an OEM's perspective

Christoph Boerensen, Ford Motor Company (Aachen)

12:00 p.m.

Panel Discussion

12:30 p.m.

Lunch

Engine Technology & Controls - Chair: Uwe Zink, Corning

2:30 p.m.

Demonstration of >10% FTP75 Cycle Efficiency Improvement for a Light Duty Diesel Engine System at T2B5 Tail Pipe Emissions Standards

Sriram Popuri, Cummins

2:50 p.m.

Improving the Fuel Economy vs. Emissions Trade-off for LDDE with Low Compression Ratio

Shizuo Sasaki and Gary Neely, Southwest Research Inst.

3:10 p.m.

Combustion System Development for Future Light-Duty Diesel Applications

Harsha Nanjundaswamy, Dean Tomazic, FEV

3:30 p.m.

Break

4:00 p.m.

Engineering the Diesel Engine for Low CO₂ and Low Emissions for the U.S. Light Duty Market

Michael Ruth, Cummins

4:20 p.m.

Cylinder Control of Emissions Using Variable Valve Timing that can Reduce NOx by 40% or PM by 44%

Robert Czarnowski, BorgWarner

4:40 p.m.

Panel Discussion

5:30 p.m.

Networking Reception – Sponsored by



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WEDNESDAY

November 2

Salons II, III, IV



Save the Date!

SAE Heavy Duty
Diesel Emissions
Control Symposium

11-12 September 2012
Gothenburg, Sweden

www.sae.org/events/hddec

TECHNICAL PROGRAM

THURSDAY
November 3
Salons II, III, IV

Reductant Systems - Chair: Uwe Zink, Corning

8:30 a.m.

Continental Breakfast / Networking

9:00 a.m.

A Lower Freezing DEF for Higher NOx Reduction Attainment

Donald Thomas, Thomas Highfield, CF Industries; **Hamid Servati**, Steve Marshall, ServoTech Engineering

9:20 a.m.

Urea Dosing Systems and Controls for Light Duty Diesel Applications

Mark Casarella, Robert Bosch LLC

9:40 a.m.

Next Generation SCR System for Fuel-Efficient NOx Reduction

Tue Johannessen, Amminex A/B

10:00 a.m.

Panel Discussion

10:30 a.m.

Break

NOx Aftertreatment - Chair: Neal Currier, Cummins

11:00 a.m.

SCR System Optimization for Future Light Duty Diesel Legislation

Julian Cox, **Todd Ballinger**, **Hai-Ying Chen**, **Joseph Fedeyko**, **Phil Blakeman**, Johnson Matthey

11:20 a.m.

Light Duty Diesel SCR Systems for Future Emission Challenges

Ulrich Pfahl, Emitec

11:40 a.m.

Reducing Emissions with Smart Catalyst Technologies

Susanne Stiebels, BASF

12:00 p.m.

Panel Discussion

12:30 p.m.

Lunch

Aftertreatment Systems - Chair: Phil Blakeman, Johnson Matthey

2:00 p.m.

Addressing Emission Challenges from Advanced Combustion Strategies

Jim Parks, Oak Ridge National Laboratory

2:20 p.m.

Selection of Light Duty Diesel Aftertreatment System Architectures for North America and Europe

Rahul Mital, General Motors Company

2:40 p.m.

Comparing Urea SCR to in-situ LNT+SCR Aftertreatment Systems for Light Duty Vehicles

Giovanni Cavataio, Ford Motor Company

3:00 p.m.

Panel Discussion

3:30 p.m.

Wrap Up and Closing

SPEAKER BIOGRAPHIES AND ABSTRACTS

WEDNESDAY

November 2

Global Regulatory Trends for Light-duty Diesel Vehicles



Joseph Kubsh

MECA

Dr. Kubsh has been involved with the development and application of mobile source, emission control technologies for more than 25 years. In that time he has been actively involved in emission control

catalyst and substrate development programs for both mobile source and stationary source applications. Dr. Kubsh joined the Manufacturers of Emission Controls Association (MECA) in 2002 and was appointed Executive Director in November 2005. MECA is a non-profit industry association that provides technical information on mobile source emission controls to air quality officials and other stakeholders

Dr. Kubsh has authored more than 25 SAE or other technical papers on mobile source emission controls, served as an SAE session organizer, and is a past Vice Chairman of SAE's Fuels & Lubricants emissions activities. In 2008 Dr. Kubsh was elected as an SAE Fellow. He received a Ph.D. in Chemical Engineering from the University of Wisconsin – Madison in 1982. Prior to joining MECA, Dr. Kubsh worked on developing automotive catalyst technology with W. R. Grace & Co. and Engelhard Corp. (now BASF Catalysts).

Abstract

The presentation highlights the latest regulatory trends for light-duty diesel vehicles in the major world markets of the U.S., Europe, Japan, South Korea, China, and India. The review includes a discussion of both existing and future exhaust criteria pollutant emission standards and greenhouse gas emission limits for new light-duty diesel vehicles sold in these markets.

Notes

SPEAKER BIOGRAPHIES AND ABSTRACTS

WEDNESDAY

November 2

Emerging Trends in Light-Duty Emission Control and Efficiency



Timothy Johnson

Corning

- Director – Emerging Regulations and Technologies, Corning Environmental Technologies
- Responsible for tracking emerging mobile emissions regulations and technologies to help

develop strategic positioning via new products.

- 25 years with Corning Incorporated
- 14 years in the current position.
- Frequent speaker on diesel emission control technology and trends
 - Gives popular annual reviews at the SAE (Society of Automotive Engineers) Congress and US DoE Directions in Engine Efficiency and Emissions Reduction Conference (DEER Conference)
 - Active on numerous advisory panels
 - Government
 - Organizations
 - Universities
 - Edited the book, “Diesel Filter Technology”, published by SAE 2007
 - 2007 and 2010 Lloyd L. Withrow Distinguished Speaker Award from SAE
 - 2008 Fellow membership grade by SAE
 - 2010 California Haagen-Smit Clean Air Award recipient
- Doctor of Science from MIT in 1987. BS (1978) and MS (1979) Engineering Degrees from the University of Minnesota

Abstract

This presentation will review the field of light-duty emission control with the intent of highlighting representative studies that illustrate the state-of-the-art. First, the author reviews regulatory requirements and general engine technology approaches for light-duty diesel and gasoline applications. The presentation then reviews: diesel particulate filter (DPF) technology, covering regeneration strategies, filter properties, and catalysts; NO_x control by SCR (selective catalytic reduction) and HC-based approaches, and diesel oxidation catalysts (DOC). The author also summarizes the field of gasoline emission control, with focus on the emerging PN regulations in Europe and the LEVIII regulations in the US.

In general, there is increasing emphasis on fuel economy and CO₂ emissions. Advanced engine technologies will play a key role. Progress is impressive and studies demonstrate that high-efficiency systems are within reach in all highway vehicle sectors. Engines are making impressive gains, and will increase the options for emission control. Filter technology is focusing on optimization, with work being done on better ways to regenerate the filter and improve system back pressure and durability. SCR NO_x control is focusing on low-temperature performance and system control, and is moving into optimization. DOCs balance HC and CO light-off with NO₂ generation, and new formulations are dropping light-off temperatures. Gasoline PN control can largely be accomplished with engine modifications, but gasoline particulate filters are very effective and have minimal adverse effects. Three-way catalysts are reducing emissions much further at reduced precious metal loading.

Notes

WEDNESDAY

November 2

Engineering the Diesel Engine for Low CO₂ and Low Emissions for the U.S. Light Duty Market



Michael Ruth

Cummins

Mr. Ruth is Director of Advanced Light Duty Engines at Cummins Inc. and is currently leading the effort to demonstrate diesel at T2B2 in a half ton pickup truck in partnership with the Department of Energy, Johnson-

Matthey and Nissan. With over 20 years of experience in the diesel industry, Michael has been focused solely on emission control and performance development.

From 1996 to 2005 Mr. Ruth was a senior leader for Cummins, who in partnership with the Department of Energy, demonstrated truly clean diesel technology. Managing a team of engineers, Mr. Ruth led the development work that resulted in an engine and vehicle system that was able to demonstrate tier two, bin five (T2B5) emissions capability while maintaining the fuel economy advantage of a diesel engine.

Michael was also a key member of the team that delivered the 2007 Dodge Ram with the Cummins 6.7L diesel to the market. This engine and vehicle achieved 2010 certification a full three years ahead of EPA requirements.

Mr. Ruth holds a BSME from Rose-Hulman and a Masters of Engineering from Purdue University.

Abstract

The light pickup truck class of vehicles in the United States is unique in the world. U.S. consumers use light pickup trucks as daily commuter vehicles and weekend workhorses. Outside of the U.S., the light pickup truck is very utilitarian and used more commercially than for personal use. OEMs have been successful in building light pickup trucks by continuing to add to a portfolio of desirable attributes that have filled the U.S. market space because U.S. consumers value the aforementioned vehicle flexibility. New regulations will affect the ability of OEMs to sell vehicles that are as capable as today's light pickup trucks without compromise. In order to satisfy customer requirements in the light pickup truck market, the powertrain solution must be cost competitive with other options, it must be profitable for the OEM, and it must be desirable for the consumer all while satisfying the regulatory requirements for criteria and greenhouse gas emissions. Diesel powertrains could be one solution to help meet the new regulations without any compromise for the consumer. The diesel engine systems for light pickup trucks will need to be engineered differently from the diesel engine systems used in today's heavy-duty diesel pickup trucks to meet all the needs; OEM, consumer and environmental regulatory agencies. A method of practice for how to successfully go about meeting this challenge will be presented.

Notes

SPEAKER BIOGRAPHIES AND ABSTRACTS

WEDNESDAY

November 2

Cylinder Control of Emissions Using Variable Valve Timing that can Reduce NOx by 40% or PM by 44%



Robert Czarnowski

BorgWarner

Robert S. Czarnowski is currently Business Development Manager for the Borg Warner Advanced Technology Group. In this corporate post, Bob oversees and manages potential market and

business opportunities for emerging technology, guides corporate product strategy, and monitors external regulations. Prior to this, he served as Director of Engineering for the Emissions Business Unit of Borg Warner. He has been with BorgWarner for 15 years.

Mr. Czarnowski began his career in 1971 in the field of biomechanics research and automotive safety, working for the University of Michigan and Firestone. Subsequently, he moved to General Motors for 15 years and entered the powertrain field, holding increasingly responsible positions in numerous engine design and development programs.

From there, he moved to the supply base holding various engineering management positions in the engine component field with Coltec Industries and Borg Warner.

Bob is a graduate of the University of Michigan, where he received B.S. and M.S. degrees in mechanical engineering and holds 5 patents, 3 which are used in production. He is also a member of the Society of Automotive Engineers and the American Society of Mechanical Engineers.

Abstract

Improving the modern diesel engine's NOx / Soot tradeoff without giving up fuel economy continues to be a major goal during engine development. One of the options not yet fully investigated for the diesel is applying variable valve events to the engine breathing process. Full engine testing using realistic valve train technology is seen as key to judging its true performance because it covers not only combustion benefits but also influences like engine pumping on emissions and CO₂.

This presentation focuses on testing a production feasible variable valve train technology on a fully instrumented modern common rail diesel engine. Applying a concentric intake cam in the described way to increase valve event duration allows running an over expanding combustion cycle (Miller Cycle). The benefits on the NOx / Soot tradeoff as well as other effects will be presented.

Notes

THURSDAY

November 3

A Lower Freezing DEF for Higher NO_x Reduction Attainment

Donald Thomas, Thomas Highfield, CF Industries; Hamid Servati, Steve Marshall

ServoTech Engineering



Donald Thomas is the Director of Technical Service and Quality Programs for CF Industries. He has over 25 years of experience in Corporate R&D, Industrial Sales Development and Quality Management for Mississippi Chemical, Terra Industries and CF Industries. He holds 3 US

and multiple International Patents. He is currently responsible for the Manufacturing Quality Programs at CF's 8 US and Canadian manufacturing sites including 4 sites manufacturing Diesel Exhaust Fluid. Donald is currently active on the CEFIC committee developing International Standards for Marine Grade Diesel Exhaust Fluid and the ASTM D15.25 committee developing standards for DEF analysis. Donald also works closely with the American Petroleum Institute for the development of DEF Quality Programs in North America. Donald holds B.S. and Master's degrees in Physical Chemistry from Mississippi College and an M.B.A. from Millsaps College.



Tom Highfield is the Director of Product Development, Quality and Engineering for Terra Environmental Technologies (TET), a division of CF Industries. Tom graduated from the University of Western Ontario, Canada, with a Bachelors of Chemical Engineering Degree and is a registered Professional Engineer

within Canada. With over 16 years of experience, Tom has held various Engineering and Managers roles within ICI Canada, Terra Industries and CF Industries. Currently Tom is a Director responsible for working with OEM's, Distribution Partners and Direct Customers, developing and implementing solutions for the Diesel Exhaust Fluid market.

Abstract

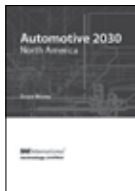
This presentation presents experimental data and actual vehicle data performed using a lower freeze point Diesel Exhaust Fluid (DEF) called TerraCair Plus compared to the traditional DEF 32.5wt% urea solution. TerraCair Plus is a NEW formula ammonium formate/urea based DEF with excellent properties, characteristics and low freeze point.

Urea (AdBlue) is the preferred Diesel Exhaust Fluid, DEF, or SCR reductant for reducing NO_x from exhaust of diesel engines. In a typical mobile application, urea is stored in a tank, pumped to an injector, and injected into the diesel exhaust flow before the SCR catalyst. DEF injection rate is determined by several factors including engine operating conditions and DEF actual fluid temperature. The DEF delivery system from the storage tank to the injector is very complex and an expensive cost item on board the vehicles.

Freezing point of traditional Adblue DEF is -11°C that makes it totally ineffective in cold regions unless complex heating systems are on board vehicles. In the cold ambient temperature regions the DEF fluid becomes a solid and no NO_x efficiency is achieved until the DEF is heated up to -11°C where chemical properties of DEF changes state from a solid to a liquid. Several minutes of vehicle operation is performed with no NO_x reduction while the energy intense heating system is raising the temperature of the DEF solid to a liquid before injection can occur. The future OBD regulations may require engine to be disabled due to lack of NO_x efficiency and therefore generating numerous problems for the vehicle owner in very cold regions.

An alternative DEF fluid is the new formula TerraCair Plus fluid that freezes at -30°C and minimizes problems especially in cold regions. This paper presents the investigation results of using TerraCair Plus on a city/highway vehicle testing with over 26,000 miles and 500 hours, and 350 hours of bench studies recording NO_x efficiency, injector durability, corrosion, temperature and SCR catalyst performance.

RELATED RESOURCES FROM SAE INTERNATIONAL



Automotive 2030—North America

By Bruce Morey

This full-color book delves into key mega-trends that will guide the North American automotive market for the next 20 years: improved fuel economy, alternative fuel sources, and the emergence of the smart car.

Product Code: T-127; List: \$99.00



Particulate Emissions from Vehicles

By Peter Eastwood

Pulling together a wealth of knowledge that is currently only available through journal and conference papers, this book addresses a field of increasing international interest, research activity, and legislation.

Product Code: R-389; List: \$108.00



Green Technologies and the Mobility Industry

By Dr. Andrew Brown, Jr.

This book features 20 SAE technical papers, originally published in 2009 and 2010, which showcase how the mobility industry is developing greener products and staying responsive – if not ahead of – new standards and legal requirements.

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Practical Diesel-Engine Combustion Analysis

By Bertrand Hsu

This book examines some basic characteristics of diesel engine combustion process, and describes the commonly used tool to analyze combustion - heat release analysis. In addition, it describes the performance changes that might be encountered

in the engine user environment, with a goal of helping the reader analyze his own practical combustion problems.

Product Code: R-327; List: \$59.95

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6th AVL International Commercial Powertrain Conference Proceedings

By SAE International

The AVL International Commercial Powertrain Conference is the premier forum for truck, agricultural and construction equipment manufacturers and the conference proceedings include 21 papers from four sessions' categories.

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Engine Combustion: Compression Measurement and Analysis

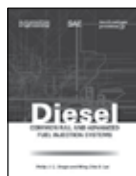
By David R. Rogers

This book provides practical information on measuring, analyzing, and qualifying combustion data, as well as details on hardware and software requirements and system components. Describing

the principles of a successful combustion measurement process, the book will enable technicians and engineers to efficiently generate the required data to complete their development tasks.

Product Code: R-388; List: \$79.95

Available as an **ebook**



Diesel Common Rail and Advanced Fuel Injection Systems

By Ming-Chia D Lai, Philip J Dingle

This publication addresses the important aspects relating to the diesel fuel injection system, explaining how we have arrived, where we are, what systems are available today, and the benefits

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Diesel Emissions and Their Control

By Magdi K. Khair, W. Addy Majewski

This book will assist readers in meeting today's tough challenges of improving diesel engine emissions, diesel efficiency, and public perception of the diesel engine. It can be used as an introductory text, while at the same time providing practical information that will be useful for

experienced readers.

Product Code: R-303; List: \$149.95

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Professional Development Courses

Check website for upcoming open enrollment dates.

Advanced Diesel Particulate Filtration Systems

This seminar covers many DPF-related topics using fundamentals from various branches of applied sciences such as porous media, filtration and materials sciences and will provide the student with both a theoretical as well as an applications-oriented approach to enhance the design and reliability of aftertreatment platforms.

Course I.D.#: C0502; visit www.sae.org/pdevent/C0502

Alternative Fuels: Impact on SI and CI Fuel Systems Distribution and Storage

This course is a primer for those professionals who desire to learn how new fuel and fuel blends could potentially impact the operation and reliability of engines powered by oxygenated gasoline, desulfurized diesel fuel and biodiesel fuel blends.

Course I.D.#: C0729; visit <http://www.sae.org/pdevent/C0729>

Diesel Engine Technology e-Seminar

This e-Seminar will explain the fundamental technology of diesel engines, starting with a short but thorough introduction of the diesel combustion cycle, and continuing with aspects of engine design, emission control design, and more.

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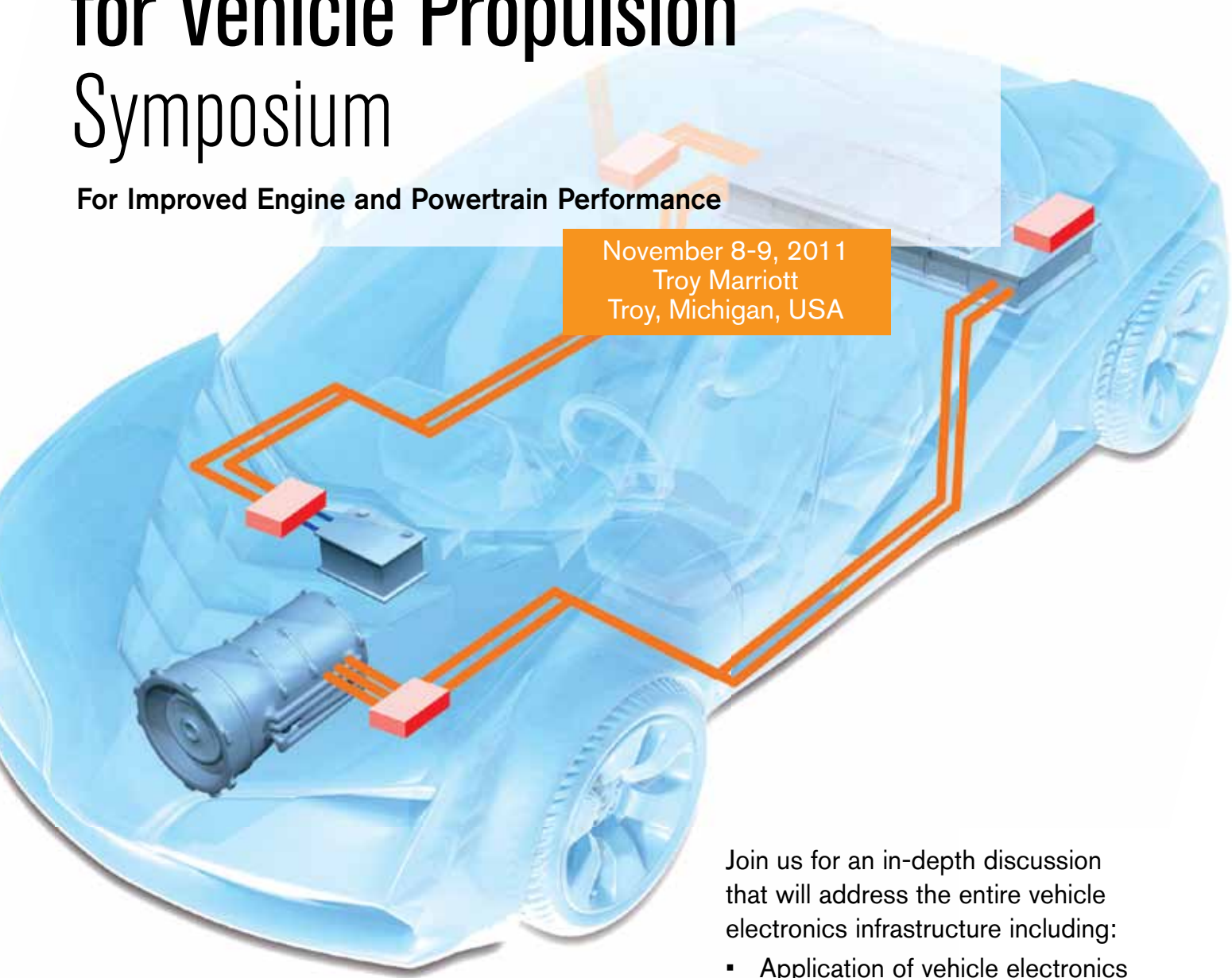
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