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The 5th International Exhaust Emissions Symposium – Trends in automotive emissions, fuels, lubricants, legislation and test methods - a global view, with a focus on the EU & US

19-20 May 2016
Bielsko-Biala, Poland

A brief overview from the perspective of the International Organising Committee

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The 5th International Exhaust Emissions Symposium, organised by BOSMAL Automotive Research and Development Institute Ltd (hereafter BOSMAL) and the Polish Scientific Society of Combustion Engines (hereafter PTNSS, from its Polish acronym) took place on the 19th and the 20th of May, 2016. The symposium was the latest in a series of scientific meetings organised at BOSMAL over the past few years.

Introduction

Concern over the environmental impact of vehicles remains high – though the specifics have changed, the fundamental problem of the negative impact of vehicles on air quality remains. While specific emissions have been reduced, growing vehicle fleets and heightened understanding of the negative impacts of emissions mean that the topic is very high on the political agenda. Taking a longer-term view, the security of the oil supply and broader energy usage concerns have become very much part of the automotive development landscape, with the majority of new vehicles sold globally subject to energy efficiency regulations of one kind or another. While the *global* contribution of road transport to anthropogenic greenhouse gas (GHG) emissions is relatively modest, their share is much higher in economically developed regions such as the EU and USA and passenger cars have been a target of efforts to reduce GHG emissions for some time. Concern over exhaust gas pollutants – perhaps most infamously CO_2 and NO_x, but also particulates and others – has become a concern for all major global markets, not just the United States and European Union.

With a proven track record of organising scientific meetings [1-13], BOSMAL proudly announced its 5th International Exhaust Emissions Symposium (IEES), with the title 'Trends in automotive emissions, fuels, lubricants, legislation and test methods – present and future'. The event built upon the successes of the past, in particular the 4th

IEES (2014) and included the very latest developments in the aforementioned fields and their implications for the various branches of the industry. Through the formation of business and personal relationships – and the potential for information-sharing and collaboration that results – the various branches of the industry can advance together towards their goals. It is for these reasons that BOSMAL decided to organise another event of this type.

The 5th International Exhaust Emissions Symposium: background, aims and structure

This fifth symposium was hosted as a direct result of the multi-dimensional successes of the previous emissions-related events hosted at BOSMAL [1-13].

The aim of the symposium was to repeat the successes of the past, by bringing together experts and specialists in a professional yet informal atmosphere, so that they might exchange information and learn from one another. Given the importance of human contact in scientific collaboration and business relationships, a social programme was integrated into the two-day event, providing ample networking opportunities.

With the assistance of PTNSS and the various patrons and sponsors of the event, steps were taken to begin to arrange the event and invite both speakers and attendees. Following preliminary negotiations dating as far back as summer 2014, the organising committee received an excellent response from invited speakers, including high-level representatives of international organisations (see the programme for details of all speakers).

Submissions to the conference were divided into three categories: keynote addresses (for which more time was allocated), presentations (delivered to the plenary audience in timeslots from 15-30 minutes) written only entries (a poster with abstract). Entries from all three of these categories were accompanied by short written abstracts, which both aid the organisation of the event and add to the archival value of the proceedings.

The event was held over two days, divided into five thematically themed sessions, two of which featured keynote addresses. The first session, entitled ‘The Automotive Emissions Landscape in the US and the EU’ was followed by ‘Emissions Reduction Technologies and Strategies’, with featured a keynote address by Dr. Timothy V. Johnson (Corning Incorporated, USA), then ‘Real Driving Emissions’, ‘Particle Matter Emissions and their Measurement and Control’ and finally ‘Fuel and Lubricant Development in Light of Emissions Requirements and Industry Trends’ which featured a keynote address by Dr. Thomas Wallner (Argonne National Laboratory, USA).

The aforementioned keynote speakers were specially selected and allocated further speaking time in order to allow the speaker to explore a topic in depth, briefing attendees on a topic deemed to be of wide-ranging interest to the industry and of great relevance to the overall topic of the event. The remaining presentations served to provide details, highlights and insights from industry and academia, thereby rounding out the sessions and providing a range of perspectives on each of the topics mentioned in the session titles. The posters were prominently displayed in the area where delegates spent the coffee breaks. Together, the keynotes, presentations and posters make up the proceedings of the event. The media partners of the event were *Combustion Engines* – a scientific journal published by PTNSS; the *DieselNet.com* website of Canada; the polish technical magazine *Przegląd Techniczny* and the Polish web portal for gaseous fuels *Gazeo*.

The event itself

The event commenced on the morning of the 22nd of May, in BOSMAL's conference room (following registration of delegates). A number of delegates had participated in BOSMAL's scientific meetings before, but there were a number of new faces, including those who were visiting Poland for the first time. Around 140 delegates attended, representing 68 firms and organisations from 20 countries and 3 continents. Organisations participating in the event included firms from the automotive and fuel industries, governmental agencies, consultancies and engineering service providers, non-profit organisations, technical universities and the European Commission. The symposium commenced with a presentation by its organiser Dr. Piotr Bielaczyc, which concluded by posing a range of questions to the audience. The presentations which followed began to provide answers to some of those questions.

The sessions of the first day were punctuated with coffee breaks (which also served as the poster presentation sessions and networking time) and lunch. The breaks also allowed attendees to inspect BOSMAL's recently-upgraded exhaust emissions laboratories, as well as engine test stands. The end of the first day – the evening of the 22nd of May – saw delegates attend the Symposium Dinner & Musical Soirée, hosted at a specially selected location close to Bielsko-Biala. As before, this evening event formed an important part of the symposium and proved a great success with friends old and new.

The final programme, which lists all keynotes, presentations and written only entries, together with listings of all authors and their affiliations, can be found in the proceedings. A full list of firms and organisations in attendance at the symposium is also presented.

The second day continued where the first day had left off, with sessions on Following that, Dr. Piotr Bielaczyc offered some closing remarks to close the event. Finally, guided tours of BOSMAL's test facilities were conducted, so that delegates might see all of BOSMAL's test facilities and departments

(which extend well beyond engine/emissions research).

Some brief comments on the technical message of the symposium

Overall, three main topics dominated the technical content of the symposium, namely: real driving emissions; effective control of NO_x and nanoparticle emissions; and the roles to be played by fuels and lubricants. Very brief overviews of each of these topics are offered below:

· While much attention has been paid to the development and introduction of the WLTP and GTR 15, incoming EU RDE testing requirements present a much greater challenge and a paradigm shift in terms of the philosophy of vehicle testing. Recent developments in both test equipment and legislation mean that attention must be paid to this area. Requirements that vehicles be tested on a route which fulfils relatively broad boundary conditions means that emissions control strategies must be viable under a wide range of engine operating conditions and ambient conditions. While NO_x emissions from Diesel engines are often mentioned as the key motivation for the development of such procedures, other regulated pollutants, CO_2 and even NO_2 will be examined via this procedure, with a range of knock-on effects on vehicle manufacturers and their suppliers. The repeatability and credibility of RDE test results remains an open topic.

· While direct injection Diesel engines have been enthusiastically adopted by manufacturers and consumers alike for the EU passenger car market, this engine type is not without its fundamental drawbacks – mainly emissions of NO_x and particulate. Increasingly stringent emissions standards and reduced willingness to grant Diesel engines their own (higher) emissions limits have lead manufacturers to introduce exhaust aftertreatment systems which have added considerable weight, cost and complexity to such powertrains. The real world performance of such systems has now been widely examined and while the prospect of lean burn DISI engines making a significant entry to the passenger car market continues to exist, but costly lessons learned from experiences with Diesel engines would also have to be applied for such applications. Current production DISI engines have a parallel in with Diesel engines in terms of particulate emissions and their control – and now in terms of legislative limits (e.g. the EU PN limit, which from 2017 will be Diesel-equivalent).

· An engine's fuel and lubricant are of vital importance – they should be considered powertrain components – and are as important as research on engine hardware, etc. Longstanding technical conventions are beginning to break down somewhat – some of the differences between "gasoline engines" and "Diesel engines" are slowly disappearing; some SI engines will soon be able to run at the high efficiency levels which were once only thought to be achievable for CI engines; the topic of gasoline compression ignition and other alternative combustion concepts continue to attract interest; pressure is mounting to increase the octane number of gasoline and thereby enable more efficient design and everyday operation of SI engines. On the subject of lubricants, it might be though that little scope for further improvement remains – however, that is not the case, as improved formulations can have measurable impacts on a range of parameters, from fuel consumption to engine wear to particulate emissions and their toxicity.

N.B.: Addy Majewski of Dieselnet (Canada), who attended the symposium, has published a technical summary, available at the following location: https://dieselnet.com/news/2016/05bosmal.php.

The journal *Przegląd Techniczny* has published a short summary in Polish (issue 16-17/2016), see: http://www.przeglad-techniczny.pl.

Overall technical message of the Symposium

Modern internal combustion engines are very clean – or at least they can be. Some of the improvement we have seen has happened only in the laboratory. The technology exists to make this high environmental performance count in the real world. For the foreseeable future internal combustion engines will be the main source of power for road transport. However, there remains scope for improvements to the engine itself, in terms of emissions and efficiency – changes in fuel type and specification will help with this, as fuel can be thought of as a powertrain component (along with lubricant and aftertreatment). The automotive industry is in the spotlight more than ever before – politicians are watching and we have to rise to meet these challenges and provide vehicles which really are clean, efficient, safe to use and fun to drive. Fortunately, we have some excellent tools and human resources available to help us with all of the above.

Closing comments; archiving of Symposium Proceedings

The 5th International Exhaust Emissions Symposium was a great success, echoing previous events [1-13], but developing and extending the concept. The International Organising Committee expresses its thanks to all those who were involved, from organisers and sponsors to speakers, attendees and those working behind the scenes with logistics, as well as all the media partners. In particular, the International Organising Committee thanks Dieselnet for making its technical summary open access.

All presentations delivered during the symposium, together with their abstracts, have been archived in the following publication: 'Symposium Proceedings – Trends in automotive emissions, fuels, lubricants, legislation and test methods - a global view, with a focus on the EU & US, ISBN: 978-83-931383-9-5, published by BOSMAL on CDROM. Film reportage is also presented on a DVD. Both of these discs will be included as attachments to the next issue of PTNSS' scientific journal Combustion Engines (3/2016), to be accompanied by a range of written papers which also form part of the event's proceedings.

Further information

A deeper analysis of the technical message of the symposium will be published in due course. Dieselnet's summary is already available at the following URL: https://dieselnet.com/news/2016/05bosmal.php; For further information on the 5th IEES and previous events of this type hosted at BOSMAL, contact the chairman of the International Organising Committee, Dr. Piotr Bielaczyc (piotr.bielaczyc@bosmal.com.pl) and visit http://bosmal.com.pl/News/7/141/ORGANISED+EVENTS.html. For information on PTNSS and its activities, see http://www.ptnss.pl/english.htm. For further information on any of the topics addressed in submissions to the symposium, contact the author/s of the presentation in question. For general contact with BOSMAL please visit BOSMAL's website: http://bosmal.com.pl/Contacts/3/56/Contact.html.

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