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# Keynotes

## The Zero Carbon Economy

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**Abstract**

The use of ammonia offers a green future that will not rely on fossil fuels. Therefore, it is critical to address how this will be accomplished. The current scenarios denote the high increase in $CO_2$ emissions and their impact to climate change, hence requiring us to act faster to enable the replacement of fuels in our highly energy consuming society. Therefore, the Keynote Speech focused on these aspects and the potential of fuels such as ammonia to achieve this aim.

Interestingly, the introduction of new fuels such as hydrogen and ammonia have spurred new markets and strengthened existing commercial ventures. Ammonia corridors are increasing, and adventurous agreements have been signed to deploy net zero fuels to energy hungry locations. Some exciting examples are the potential use of these fuels to replace fossils in marine applications, LPG across counties and towns, LNG for industrial use, and even as a replacement of Jet-A for aviation, amongst many other applications. Ammonia with hydrogen (obtained from cracking) shows promising combustion features that can make thermal systems more efficient. All this ammonia/hydrogen can be produced in places with vast renewable energy such as Africa, hence delivering green energy to countries in need of these vectors. The onset of technologies such as Fuel Cells (which require high reconversion of ammonia) and internal combustion engines running on these fuels (and that will require special features to do so efficiently and under low emissions) are all promising lines of research that will serve to establish the foundations of a zero-carbon future.

## Studies of laminar premixed flames of ammonia: approaches and perspectives

*Prof. Alexander A. Konnov*
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**Abstract**

Combustion plays a crucial role in our energy utilization today and for decades to come. However, to minimize global warming, combustion must take place with a net zero $CO_2$ emission. This motivates the search for non-conventional fuels, which could be produced from renewable sources of energy, such as wind or solar, and used in existing power installations or engines. Recently ammonia ($NH_3$) has received revitalized interest as a promising renewable and carbon-free energy carrier. Current investigations of ammonia combustion mainly focus on overcoming

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the nitrogen-based pollutant emissions and the unfavourable combustion characteristics of $NH_3$ compared to conventional hydrocarbon fuels such as its low flame temperature, low laminar burning velocity, high auto-ignition temperature, narrow flammability range, etc.

This Keynote Speech focused on the laboratory studies of laminar premixed flames of ammonia. Starting from historical examples of nitric oxide (NO) measurements in flames doped with $NH_3$, particular attention was paid to the experimental investigations of the structure of ammonia flames and its comparison with the predictions of detailed kinetic models. Accurate measurement and prediction of laminar burning velocity are important for the characterization of premixed combustion properties of ammonia, development and validation of new kinetic models, and calibration of turbulent combustion models. Therefore, numerous studies of the burning velocity of ammonia in the mixtures with other fuels, at elevated thermodynamic conditions, and in modified oxidizers were analyzed and summarized. Improvement of the combustion characteristics of $NH_3$ could be achieved by plasma impact; examples of recent developments in this field are also provided. Finally, chemiluminescence from ammonia flames could be potentially used for combustion control in practical devices. Some cases of recent measurements and an attempt at chemiluminescence modelling were discussed as well.

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