Experimental and numerical studies of the ignition of ammonia/additive mixtures and dimethyl ether burning velocities

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Propositions

belonging to the thesis entitled

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by

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1. Ammonia has autoignition delay times that are too long compared to conventional hydrocarbon fuels, which renders the use of pure ammonia particularly challenging in compression-ignition engines. (Chapter 3)

2. Adding hydrogen, methane or dimethyl ether to ammonia as a combustion promotor opens the door to use ammonia as primary fuel in current combustion engines. (Chapter 3-5)

3. One should be cautious when aiming to use hydrogen or methane to increase the burning velocity of ammonia in spark ignition engines due to the decreased knock resistance. (Chapter 3,4)

4. A novel ammonia/DME mechanism presented in this study predicts the ignition delay times of ammonia/additives mixtures very well. It can be used in ammonia combustion simulations to analyze the behavior of combustion equipment and fuels. (Chapter 3-5)

5. The oxidation of DME in the early stages of ignition via the so-called low-temperature route generates heat and reactive species that accelerates the decomposition reactions of ammonia at much lower temperature than for neat ammonia. (Chapter-5)

6. Burner stabilized flames can be used to determine free burning velocities at richer or leaner conditions than can be reached by spherically propagating flames. (Chapter 2, 6)

7. Which future transportation fuels will be used in different applications is uncertain at present. More research is required to explore the advantages and limitations of different fuel combinations.

8. Valuable experience can be earned from ‘naive’ experiments.

9. “Nothing in life is to be feared, it is only to be understood. Now is the time to understand more, so that we may fear less”. (Marie Curie)