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A flow reactor study of NH_3/DEE oxidation

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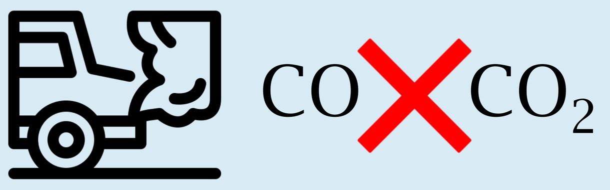
1 Introduction

Ammonia (NH_3) is a **carbon-free fuel** with strong potential for clean energy systems, though its **low reactivity limits** practical use.



Ammonia (NH_3) is a carbon-free fuel with strong potential for **low-emission** energy systems. However, its combustion is hindered by **poor thermochemical properties**, such as high ignition temperature, low flame speed, and narrow flammability limits, as well as the formation of significant **NO_x emissions**.

Blending with diethyl ether (DEE), a **highly reactive** oxygenated fuel, **enhances ignition**. This fuel mixture offers a promising enhances in key parameters such as **ignition delay time (IDT) and laminar burning velocity (LBV).**

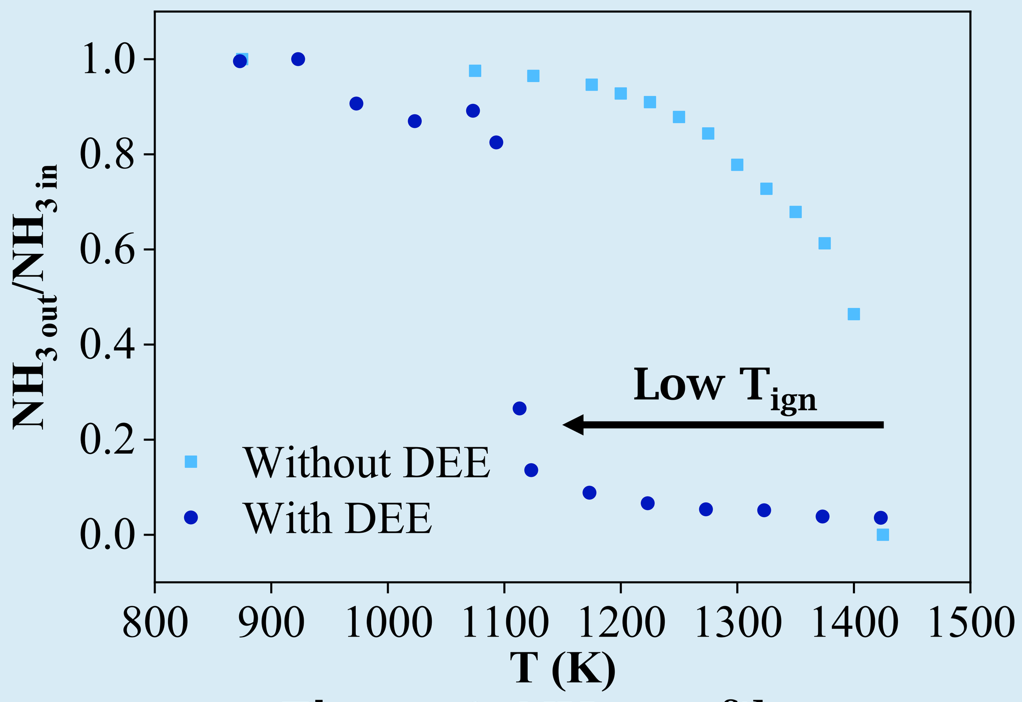
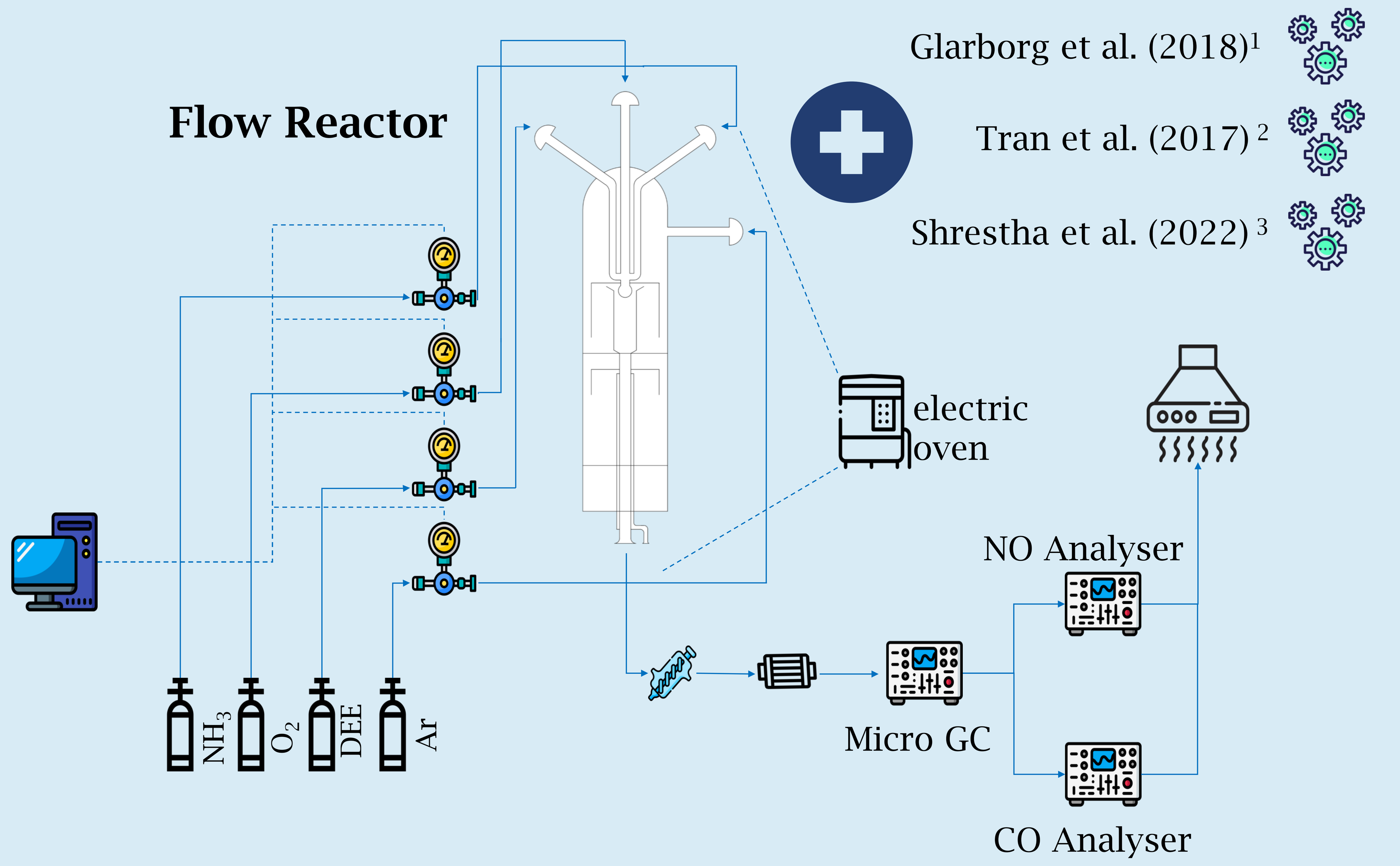


Figure 1. NH_3 profiles.

2 Methodology

Detailed kinetic mechanism



3 Results

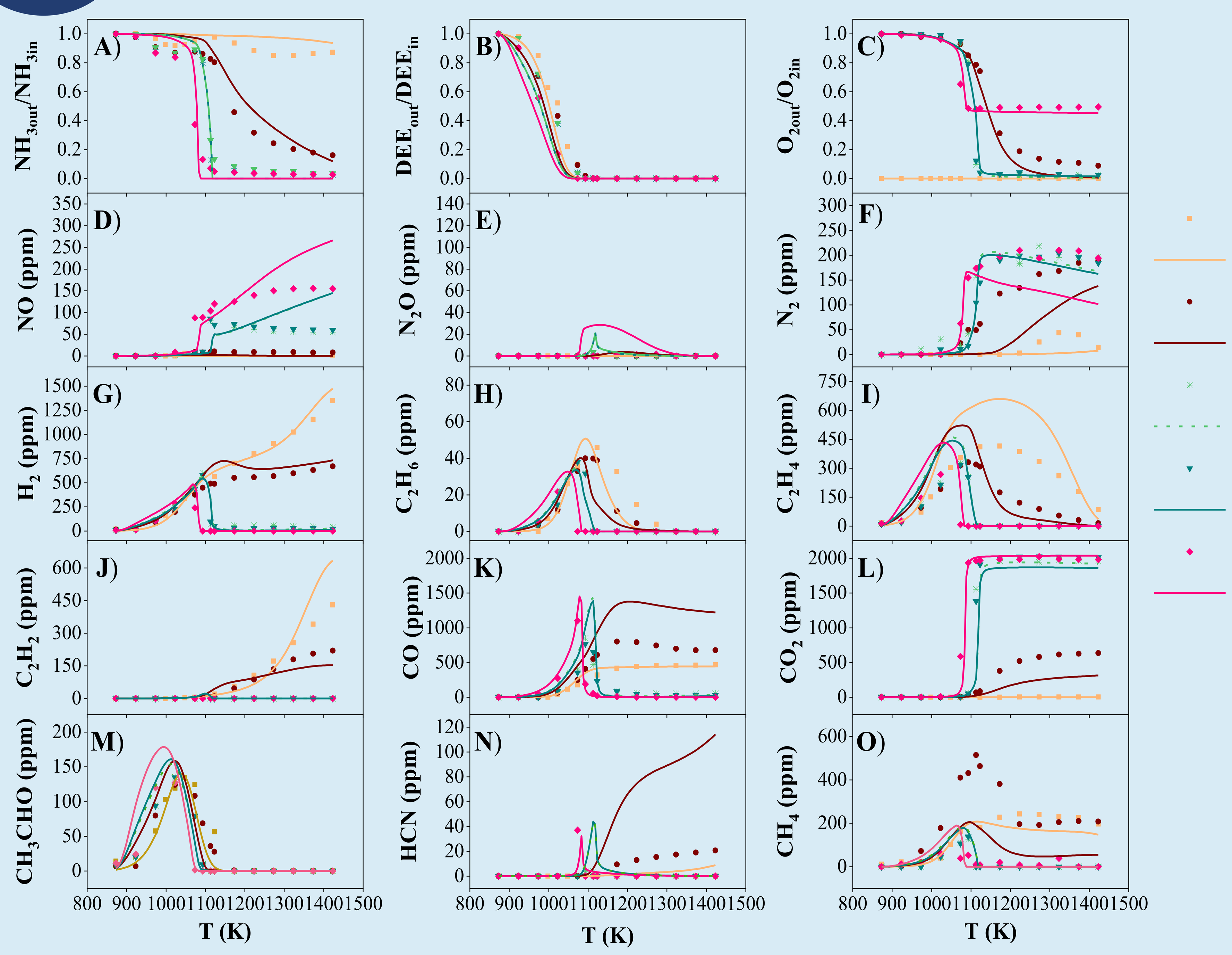


Figure 1. Species profiles in NH_3/DEE oxidation depend on λ.

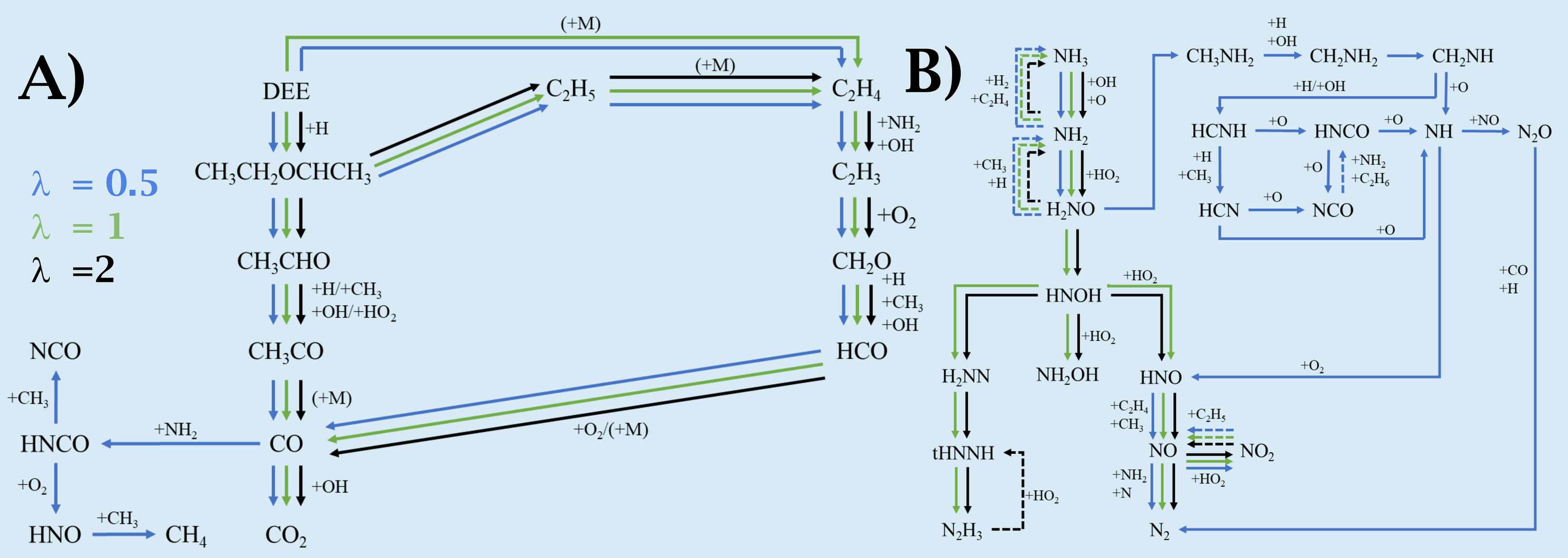


Figure 2. Reaction Pathway of A) DEE and B) NH_3

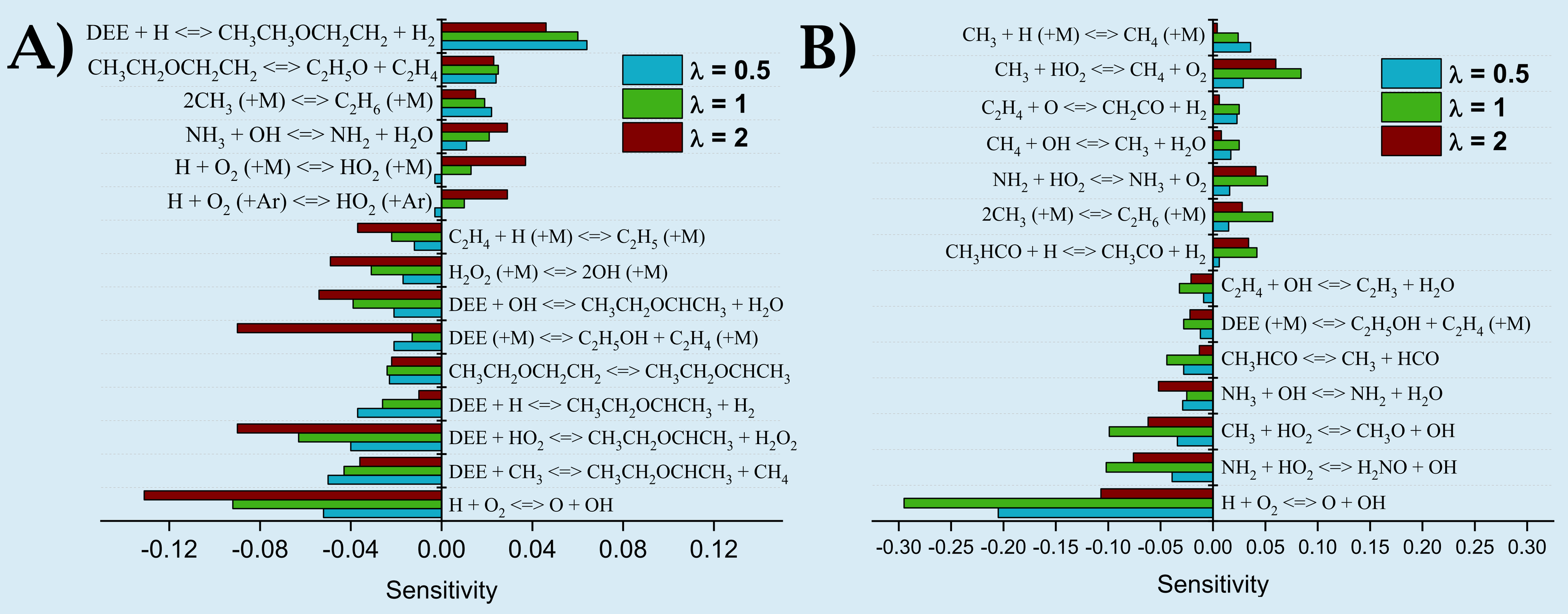


Figure 3. Sensitivity analysis of A) DEE and B) NH_3.

4 Conclusion

- ☑ The oxidation of both fuels shifts to lower temperatures as the equivalence ratio (λ) increases. This effect is especially pronounced at higher λ values, with a notable temperature drop observed for NH_3 when λ is below 1.
- ☑ Radical pool dynamics plays a key role in NH_3 oxidation, with OH and O radicals being the primary contributors. Additionally, interactions with DEE-derived species have been observed to enhance the oxidation process.
- ☑ Variations in the equivalence ratio (λ) influence the prominence of specific reaction pathways, a trend observed in both fuels.
- ☑ A kinetic model has been developed, offering reasonably accurate predictions across a wide range of conditions.

References

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Acknowledgment

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