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Numerical Modeling of Iron Powder Combustion

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Metal fuels receive a lot of attention recently as they enable storage and transport of energy from intermittent renewable sources without carbon dioxide emissions [1]. Iron powder is particularly interesting because it is non-toxic and abundantly available, but most of all because its combustion product, iron oxide, is a similar powder that can be easily captured from the exhaust stream in order to be recycled. The iron oxide is reduced back to iron using renewable electricity or hydrogen, closing the cycle.

Numerical models can help us understand the complex phenomena occurring in iron combustion processes and assist in the design of combustion equipment for iron powder. In this presentation, we will discuss the modeling of combustion of single iron particles [2, 3], as well as flame propagation in iron aerosols [4, 5] and combustion of iron powder in turbulent flow [6]. The effect of fuel-air mixture properties and modeling assumptions on relevant combustion characteristics such as ignition temperature, burning rate, and flame speed will be discussed.

References

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