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Modeling 3D effects in iron-air combustion with 1D code

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Recently, a lot of research on metal fuels is conducted [1, 2] Especially, the use of iron as an alternative, carbon free, energy carrier is considered. Even though the idea of combusting metals is not a new concept, using it as a replacement for fossil fuels is. The combustion of iron particle is quite different from the combustion of gaseous fuels. As such, more research is needed for a better understanding.

Current studies have provided significant insight into the physics of flat aerosol flames [3, 4, 5]. However, practical flames are usually modified by curvature and flow effects. To identify the extend of flow strain effects, counterflow experiments are often used. Like in gaseous flames, when studying counterflow flames, an interaction between preferential diffusion and flame stretch will influence the flame structures. However, for iron dust flames an additional component comes into play, the inertia of the particles. The situation becomes even more complicated when a particle distribution is used instead of monodispersed particles. To study the combined effects of preferential diffusion, particle inertia and flame stretch flow strain for a dispersed flow, a quasi 1D model is developed [6]. In the presentation we will discuss how 3D effects impact the 1D flame structure of iron dust flames.

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