Project, Bachelor, or Master thesis

Investigation of the ignition and combustion of pulverized solid fuels in oxy-fuel atmospheres

Topic is suitable for

- ✓ Project thesis
- ✓ Bachelor thesis
- ✓ Master thesis

Field of activity

Reactive multiphase flows

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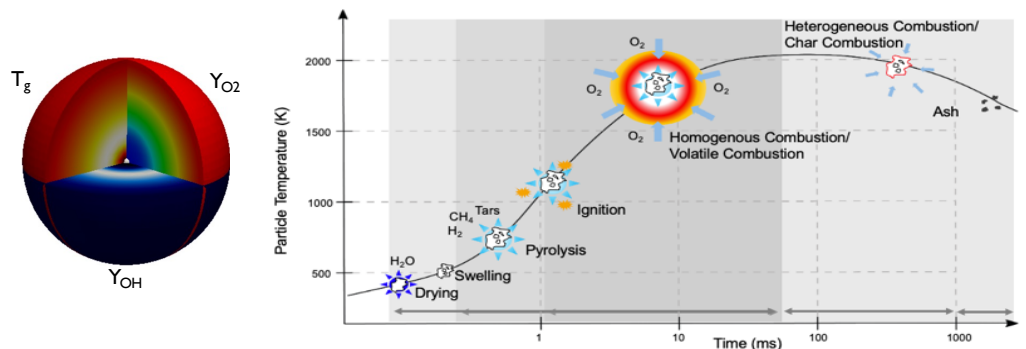
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Enhancing the efficiency of a solid fuel-powered powerplant on a large scale requires an understanding of the physics of ignition and combustion on a particle scale. Recently, increasing combustion efficiency by reducing pollutant emissions and CO_2 capture by using oxy-fuel combustion for solid fuels has been the main focus of solid fuel combustion research.

When solid fuel particles are exposed to heat, the internal chemical bonds inside the particle structure break, and as a result, gas-phase volatile species are released, which then, by reacting with the oxidizer, lead to ignition and volatile combustion. The remaining char also react at the surface with the oxidizer, leading to char burnout. The complete process is shown in the Figure 1.

Figure 1. left) Flame around a particle, right) Complete reactive lifetime process of solid particles.

Since solid particle combustion is a transient and multiphase phenomenon, simulations require detailed models to describe these fuels' behavior under combustion conditions. Our research team aims to study this transient behavior in different conditions using fully resolved simulations and provide accurate models for improving large-scale simulations. Therefore, modeling the ignition, combustion, and pollutant formation of solid fuels such as biomass is the main focus of this project.

Your tasks

- ◊ Develop a C++ numerical framework to predict solid particle combustion.
- ◊ Investigate different solid-phase and gas-phase kinetics.
- ◊ Parametric study in different configurations to investigate ignition prediction.

About you

This thesis might be suitable for you, if you:

- ◊ Are interested in programming and numerical modeling
- ◊ Have some experience with Linux (desirable)
- ◊ Are self-motivated and are willing to advance your knowledge and skills

If you are interested, this thesis can be combined with a Hiwi position. Contact us for more details.

This thesis does not quite fit your ideas? Feel free to contact us to customize this topic or to find an alternative thesis.