What do we know about fire?

Anton Linnér

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Why would someone want to study the way a flame behaves? Is there some sense to knowing every component and chemical reaction of a candle? Well, one might not realize it but knowledge about how flames work is what is keeping astronauts rockets from fading in space like a candle would without air. A jet engine would not survive in space even though it might look very similar to a rocket engine. The difference is quite simple, a jet engine will use oxygen from the surrounding air in combination with its fuel to create combustion. This is similar to how a normal candle works. For a rocket, the oxygen is supplied by the engine itself, making it survive in places where there is no oxygen. This is only one example on where knowledge about combustion is applied.

It is quite common to be aware of the fact that for there to be a flame, there needs to be fuel. But there are other aspects that affect a flame other than just which fuel is being used and if there is enough oxygen. For example, how well are the molecules in the fuel being transported to the flame? And does this have an impact that is worth being concerned about? The answer is yes. And no. For some cases this (i.e. molecular movement and transport) has a large impact when it comes to trying to figure out how a flame or a combustion process works. And sometimes it plays a small role. It depends on what kind of process or flame we are looking at. Is it a normal candle or is it a rocket engine? Are the molecules in the fuel large and heavy or are the small? Sometimes it might be a waste of time to look very closely at how the molecular transport is conducted compared to trying to understand the chemical reactions. But sometimes, a flame cant be fully described without looking at the transport.

Many times the flames are observed through simulations rather than real experiments. In the simulations there might be several thousand reactions occurring, making it hard to find computers with enough computational power. It is common to sometimes omit some of these reactions, in a sense trading accuracy for computational capability. Here it might sometimes be useful to include some aspects of molecular transport to compensate for the loss in accuracy.

The goal of this project was to see to what extent (if any) one might increase the accuracy by having very accurate information about the molecular transport. As previously mentioned, the molecular transport varied in importance when it came to describing the full picture. It might therefore not be very shocking that the project came to the conclusion that the putting heavy emphasis on knowledge about the molecular transport *almost* always improved the results,

but not always. Though the improvements could be very large.

In conclusion one might say that unless you're sure that your flame wont be affected by better knowledge on the movement of molecules, you better put some effort in to getting the knowledge.