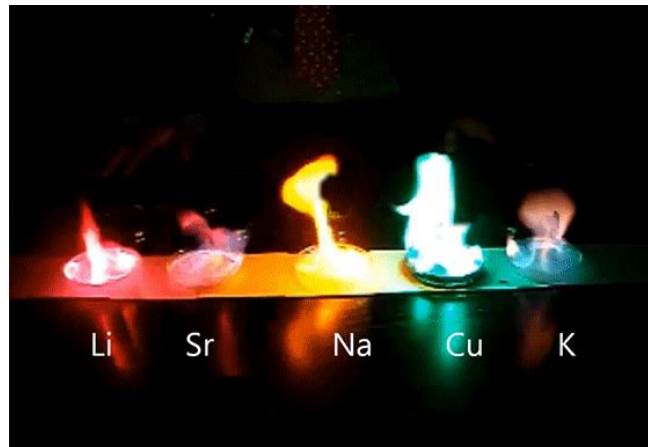


Yuhe Zhang

Flame temperature measurement based on alkali fluorescence

Are you curious about what is happening when you look upon the sky seeing beautiful fireworks? Have you ever stared at the candle wondering what is inside the flame when you enjoy a candlelit dinner? They are all about combustion physics.



People are not strange to combustion since our ancestors firstly knew how to generate a fire. What you may not know is flame can emit colorful fluorescence when metal atoms are added, as shown in the figure above. Different metal atoms show different flame color. For sodium, the flame color is yellow; while for potassium, it is purple red. This bright fluorescence emitted by the metal atoms can provide us with abundant information about the flame.

This project aims to find the relationship between the flame temperature and the alkali metal fluorescence intensities. It is possible to develop a temperature-measurement method based on this relationship. We established a theoretical model to describe the temperature dependence of the three-component fluorescence intensity ratio $\text{Na Li}/\text{K}^2$ and the two-component ratio Na/K based on the understanding of involved physical and chemical process. The temperature dependence of those two ratios was also measured from experiments and compared to the prediction.

The cheapest and most common way to measure the temperature in laboratory today is using a temperature sensor called "thermocouple", which, however, is unstable and inaccurate. If a more accurate temperature is needed, it is very expensive. Therefore, it is valuable to investigate the temperature sensing of alkali metal or other atoms and hopefully develop a novel temperature-measurement method based on related researches. Imagine how convenient it will be if we can obtain the temperature of flame by just spraying some fuel additives to it!

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