Exploring Continuous Wave Laser-generated Combustion Spectroscopy: Developing a Cost-effective Metal Identification System

Bright, Shane (School: Central Virginia Governor's School for Science and Technology)

The greatest technological advancements on planet Earth are typically attributed to the honing of metalworking throughout history, leading to the development of modern machining, construction, and manufacturing processes. However, there are many unidentified metals that sit in heaps of unused potential. The most accurate and definitive identification methods are based on spectroscopy (identifying light). Unfortunately, they are also typically the most expensive forms of identification. This can cause one to formulate the hypothesis that if one experimentally uses a continuous wave (CW) ytterbium-doped 2000 watt 1080 nanometer (nm) laser to combust a small portion of a target material surface, one would be able to accurately identify important compositional features, such as carbon content. Hence, this research focused on creating an accurate, modular, and cost-effective system for spectra-based metal identification. This was done by combusting a portion of 56 different sample metals with a laser and analyzing the emitted spectra using various Python programs created by the researcher. Furthermore, while decreasing the cost, the system itself has a much larger number of uses over traditional methods due to the selection of laser. After testing the experimental setup, the system was demonstrated to be useful and accurate based on the data collected in the study. The hypothesis was certainly supported, with a level of accuracy surpassing initial expectations for a newly developed system. There are opportunities for improvements to the methods and procedures outlined in this study; nonetheless they have been demonstrated to be useful even in their current state.

Awards Won: