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Optical Pumping Within a Laser-Induced Plasma to Enhance Trace Element Signal Intensity

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In the field of laser-induced breakdown spectroscopy (LIBS), it has been shown that trace elements can typically be detected at the parts per million level. However, to decrease the limit of detection further, there is a need to enhance the relatively small spectral lines of the trace elements. The technique of laser-induced fluorescence (LIF) is one of the best tools for providing this enhancement. A wavelength-tunable optical parametric oscillator (OPO) laser is used on resonance to selectively populate an excited state within the laser-induced plasma. Subsequent spontaneous emission will then be increased relative to the un-pumped plasma allowing smaller concentrations to be detected.

This poster will present our efforts to demonstrate LIBS-LIF in a LIBS plasma generated by a 10 ns 1064 nm pulsed laser. Initial studies pumped trace zinc in a brass alloy. Parameters investigated included interpulse timing, OPO laser spot size and pulse energy, background gas environment, and plasma observation timing. This technique will be implemented to improve the measurement of trace zinc in fingernails as well as trace elements in bacterial specimens.

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