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**Analysis of new and aged energetic residues using $CO_2$ enhanced Laser Induced Breakdown Spectroscopy** JORGE MARTINEZ, CHARLEMAGNE AKPOVO, STACI BROWN, Florida A and M University, CLEON BARNETT, Alabama A and M University, DAWN LEWIS, LEWIS JOHNSON, Florida A and M University — $CO_2$ enhanced LIBS plasmas have several positive attributes such as longer plasma lifetimes and excellent ionic/neutral/molecular emissions relative to the plasma heating and cooling processes. In this experiment, a study of decay constants as related to enhanced $CO_2$ plasmas for various elemental and molecular elemental features are studied for frozen (recently obtained) and room temperature stored (3 year old) energetic residues. The difference between these aged residues and new residues will provide insights into the types of elemental profiles significant to energetic detection in both ambient atmosphere and real world environments. 10 milli-Joule nanosecond and femtosecond pulses were combined with 3 J defocused $CO_2$ pulses. Four spectrometers were utilized (2 broadband, 2 high resolution) to acquire spectra at 1.5 and 10 microseconds after plasma initiation. The samples consisted of 10 mg/ml concentrations of DNT, TNT, and RDX allowed to dry on aluminum and silicon substrates. Differences in decay of nitrogen and hydrogen emissions as a function of time were observed in aged vs fresh TNT samples. DNT aged and fresh decay constants for ionic and neutral species showed good agreement. RDX (fresh, aged) and TNT (aged) displayed reduced emissions of molecular species of the $C_2$ swan band and violet band CN as compared to DNT (fresh, aged) and TNT (fresh).

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