

Stand-off Detection at the DLR Laser Test Range Applying Laser-Induced Breakdown Spectroscopy

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The DLR laser test range at Lampoldshausen allows for optical measurements under daylight conditions at distances up to 130 m. This infrastructure is very suitable for the development of stand-off detection systems of biological, chemical and explosive hazardous substances. In a first step, laser-induced breakdown spectroscopy (LIBS) has been introduced to this test site. A basic LIBS set-up and first LIBS spectra of selected samples are presented. A Nd:YAG laser beam was focussed by a Cassegrain type telescope onto different samples at distances exceeding 50 m. The light of the generated plasma plume was collected by a Newtonian telescope, and analyzed by a gated broadband CCD-spectrometer system.

The Nd:YAG laser yields pulse energies up to 800 mJ at a wavelength of 1064 nm and a pulse width of 8 ns. Optionally the second and third harmonics can be extracted. LIBS spectra from 10 nm layers of gold on a silicon wafer were recorded. In addition, LIBS spectra from black powder were measured, and compared to the spectrum of potassium nitrate, which is a main component of black powder and shows very characteristic emission. LIBS spectra of the above samples have also been acquired with an excitation laser wavelength in the eye-safe region. Recorded spectra are measured as a function of the laser wavelength, pulse energy, and energy density on the target and are compared to the literature.

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