



## Sensor for Detecting Carbon and Nitrogen in Soil Laser-induced Breakdown Spectroscopy (LIBS)

### Introduction

Carbon sequestration in the terrestrial biosphere, or more specifically storage of carbon in soils, offers an attractive option for carbon management. Soil organic carbon represents an especially large pool of carbon in many ecosystems and there has been increasing emphasis placed on enhancing carbon sequestration in this pool. However, existing methodologies for measuring soil organic carbon and other soil elements including nitrogen are time-consuming, analytically expensive, and often require unreasonable replication in order to identify statistically significant differences between or among treatments. Thus, there is an immediate need to develop field-portable instruments that can easily and reliably measure carbon and other elements in soils.

### Technology Description

Laser spectroscopic techniques are important in chemical analysis because they offer real-time monitoring capabilities with high analytical sensitivity and selectivity. In the case of the LIBS technology, a pulsed laser vaporizes a small volume of sample material and induces optical excitation of the elemental species in the resultant sample plume. The vaporized species then undergo de-excitation and optical emission on a microsecond time scale, and time-dependent ultraviolet-visible spectroscopy is used to fingerprint the elements associated with the spectral peaks. Each element has a unique fingerprint, a very specific wavelength at which it undergoes optical emission. Therefore, LIBS allows for unambiguous identification of virtually all elements from the periodic table.

### Advantages Over Existing Technologies

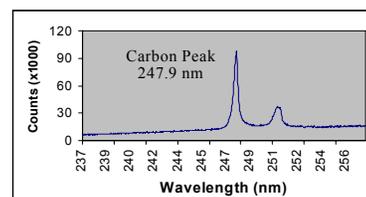
- Accurate and reliable detection of carbon, nitrogen, and other elements in soils and complex matrices.
- Cost-effective and less labor intensive than other technologies.
- Amenable to miniaturization and field-portable.

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*Laser-induced breakdown spectroscopy for soil carbon and nitrogen detection.*



*Detection of carbon peak using LIBS technology.*