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ADVANCED INSPECTION OF MATTER USING LASER-INDUCED BREAKDOWN SPECTROSCOPY. **Javier Laserna**, Department of Analytical Chemistry, University of Málaga, 29071 Málaga, Spain

Development and application of advanced laser technologies for materials characterization offer quick-turn-around, cost-effective solutions to a variety of research and technical problems in diverse application areas, including microelectronics, process monitoring technologies, environment, cultural heritage, defense and security, and steel products and processes. Among the many approaches based on lasers, laser-induced breakdown spectroscopy (LIBS) constitutes nowadays one of the most interesting analytical technologies. LIBS is well known for its plasticity or capacity to provide solutions to a number of chemical measurements which are difficult or impossible for other well established analytical techniques. For instance, LIBS is capable for providing the composition of distant targets. Although several measurement principles using LIDAR technology have been used for interrogating the composition of matter at long distances, LIBS is unique in its capacity for describing the atomic composition of solids. In this talk, the instrumentation and analytical approach for two extreme applications of laser-induced breakdown spectroscopy will be presented. LIBS analysis of single nanoparticles isolated by optical catapulting and trapped by levitation will be first discussed. Samples in powder form are first aerosolized by optical catapulting using a pulsed solid state laser. Particles of the aerosol are then trapped in the optical field of a CW laser, where the analysis is completed by LIBS. Particles with mass in the order of a few femtograms are analyzed with satisfactory precision. The use of LIBS for inspection of submerged objects will be also presented. Underwater measurement of the atomic composition of solid targets is achieved by delivering laser pulses through a 50-m long optical fiber and focusing the radiation with a laboratory designed train of optical elements fitted into a hand-held probe. Plasma formation is achieved at sufficient irradiance on the submerged sample. Light is then transferred by the optical fiber to a spectrometer, where spectral analysis is performed. The system is deployed in the board of a vessel, whereas the hand-held probe is operated by a diver for materials inspection in the ocean at depth of up to 45 m. The system developed at University of Málaga has been tested in two measurement campaigns. The picture shows a diver using the probe for the analysis of materials of a shipwreck.

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