Cutting-edge laser technology for crime labs developed by FIU research team

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By Susan Feinberg

Jose Almirall, director of FIU's International Forensics Research Institute (IFRI), and his research team have been attracting national attention for their cutting-edge research on how laser-induced breakdown spectroscopy (LIBS) can be used in crime labs.

Although this technique, which uses a laser to vaporize materials to analyze their chemical composition, has been around for a while, Almirall's team is finding new applications for it. NASA will be deploying a LIBS system called the "ChemCam" on its new Mars rover, Curiosity, which is scheduled to launch next year.

Dr. Jose Almirall and his research group at Modesto A. Maidique Campus

Determining the precise composition of a substance with LIBS can provide important evidence in legal proceedings. Trace elemental analysis for comparisons of glass, paint chips, soils, paper, ink on paper and metal fragments has been shown to be highly effective. However, the instrumentation required for this kind of analysis in forensic comparisons has been beyond the reach of many forensic laboratories.

Almirall and his researchers, funded by a grant of nearly $300,000 from the National Institute of Justice, are analyzing how LIBS performs in comparison to more established methods for doing elemental analysis of materials that are traditionally used by crime labs, such as Laser Ablation Inductively Coupled Plasma (LA-ICP-MS) and X-ray Fluorescence (XRF).

"The LIBS technique has been around as long as lasers have been around," Almirall explained. "What's different now is that the lasers are very cheap and very stable, and the detectors that are used to observe the light spectrometers are also very cheap and very dependable. This has led to LIBS' rapid development in the last 15-20 years."

"The LIBS technique also has the advantages of much greater simplicity in operation and data interpretation, in addition to lower costs of equipment acquisition and operation, in comparison to other techniques," Almirall added.

In late 2009, Almirall and his group of researchers played a key role in the first court case in which a LIBS analysis was used. The technique helped identify a would-be bank robber in Maryland by the glass on his clothing. After being locked in a vestibule by secret alarms, he shot his way out and sped away. After being apprehended, some pieces of glass were found on his clothes. When Almirall's team compared the precise composition of that glass with the glass from a window that was broken from the bank, they came back with a probable match.

There are already five companies interested in commercializing LIBS instrumentation for various applications, including Applied Spectra of Fremont, California, and Stellar Net of Tampa, Florida. Almirall is considering how to briefcase the LIBS system to test products for U.S. Customs to ensure their safety and provenance.

"The portability of LIBS and the simplicity of operation make it amenable for uses such as detecting lead in toys at border check points," Almirall said. "You don't need a chemist to conduct the analysis, and the instrument can be miniaturized and made portable."

Almirall predicts that crime labs will be increasingly using LIBS in the future.

"The trend will be to move towards tools that are easy to use and inexpensive and can be taken to the field. LIBS can fulfill all these requirements," he said.

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