



Engineering Sciences Section – 2004

C5 NIST Standard Reference Materials (SRMs) for Forensic Measurements and Analysis

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After attending this presentation, attendees will learn how to use NIST Web-based resources and available NIST Certified Standard Reference Materials which provide the benchmarks of precision, accuracy, and traceability to validate measurements to be used as evidence.

This presentation will impact the forensic community and/or humanity by describing to the forensic community the valuable resources available from the National Institute of Standards and Technology (NIST) on Standard Reference Materials which can be used to validate measurements in forensic evidence.

Presently available NIST Certified Standard Reference Materials (SRMs) related to measurements and characterization of specimens for linkage to forensic evidence are described. The NIST SRMs Web presence and its navigation techniques are also demonstrated.

This paper discusses physical and chemical properties of certified NIST SRMs related to measurements in the identification and/or comparison of specimens to be linked to forensic evidence. NIST supports accurate and compatible measurements by providing over 1300 Certified SRMs with well-characterized composition and/or properties. These SRMs are used to perform instrument calibrations in situ as part of overall quality assurance programs, to verify the accuracy of specific measurements, and to support the development of new measurement methods. NIST SRMs are currently available for use in areas such as industrial materials production and analysis, environmental analysis, food and agriculture, radioactivity, health measurements and basic measurements in science and metrology. Each SRM is supplied with a Certificate of Analysis. Along with other standardization organizations methods and procedures, such as ASTM and ANSI, NIST has published many articles and practice guides that describe the development, analysis and use of SRMs. These SRMs provide the benchmarks of precision, accuracy, and traceability which validate the evidence.

The measurement of physical, optical and chemical properties of materials samples are often employed to identify the type of material and/or application. Measurements of material properties can be used to track and identify the original producer, the date or period of manufacture and the intended use or application for the material or product. For example, property or chemical measurements and/or the evaluation of materials or product characteristics, in addition to visual markings if present, can establish a link in the chain from producer, fabricator, distributor, vendor, end-use or application, down to a specific geographical area or sample origin.

In the measurement of properties, chemical composition, or characteristics of a material, accuracy and uncertainty terms and traceability statements are of paramount importance in the validation of evidence for forensic investigations. These concepts must be used correctly to avoid possible confusion and inadmissibility of evidence. SRMs and the associated Certificate or Certificate of Analysis documentation state the intended purpose and application of a particular SRM, its certified property value(s) with associated uncertainty (ies), and present technical information deemed necessary for its proper use. The uncertainty attached to a certified value is especially important as it represents a quantity which characterizes the range of values within which the true value is asserted to lie with a stated level of confidence. A NIST SRM certificate bears the logo of the U.S. Department of Commerce, the name of NIST as certifying body, and the name and title of the NIST officer authorized to accept responsibility for its contents. In addition to the certified values, the SRM certificate may contain references and/or other pertinent information and data. Certified values for SRMs with their associated uncertainties, in applicable situations, insure the integrity and the validation of forensic measurements. NIST-certified values are obtained by one or more of the following measurement modes: 1) A definitive (or primary) method using specialized instrumentation capable of high accuracy and precision and whose errors have been thoroughly investigated and corrected; 2) Two or more independent methods at NIST using commercial instrumentation that is calibration based and with differing sources of systematic errors; or, 3) Interlaboratory data from selected laboratories using multiple methods and SRMs as controls. However, the sources of error with the latter mode will generally result in uncertainties greater than those for the other two modes.

There are a number of measurement methodologies related to the determination of materials properties and/or chemical composition. For instance, chemical composition methods cover basic "wet chemistry" procedures and other very sophisticated techniques, which utilize atomic and radiation physics principles, and nuclear interactions that require complex and expensive apparatus. Fortunately, a number of SRMs having components comparable with those of the materials to be evaluated have been established. These SRMs and associated methods or standard procedures are available for equipment calibrations.

This paper will discuss and illustrate the use of a number of SRMs of interest to the forensic community. The discussion will encompass measurement practices, methods, standards, and precision and accuracy considerations to be taken into account for the measurement methodologies employed. This paper will



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also provide insights on the future needs for SRMs to be utilized in measurements and materials characterization.

Standards, Reference Materials, Calibrations