



## Questioned Documents Section – 2007

### J14 A Comparison of the Physical and Chemical Characterization of Conventional Toners vs. Chemically Prepared Toners

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After attending this presentation, attendees will gain a better understanding of how conventional and chemically prepared toners are prepared and how they can be analyzed, from an evidential standpoint, to provide valuable forensic information.

This presentation will impact the forensic community and/or humanity by providing the forensic community with fundamental information regarding the raw materials, manufacturing processes and analytical characterization of both conventional and chemically prepared toners, which are frequently encountered in questioned document cases.

The characterization of conventional toners, prepared by melt mixing and grinding processes, has been well documented. As toner manufacturers have begun a changeover to new “chemically prepared toners,” or “CPTs,” the physical and chemical characterization of these revolutionary materials has not been reported. After attending this presentation, attendees will better understand how conventional and chemically prepared toners are prepared and how they can be analyzed, from an evidential standpoint, to provide valuable forensic information.

Commercial toners are produced for use in various office machine systems, including photocopiers and laser printers, which are frequently associated with criminal cases involving questioned documents. This presentation will provide the forensic community with fundamental information regarding the raw materials, manufacturing processes and analytical characterization of both conventional and chemically prepared toners, which are rapidly becoming the predominant product lines in the worldwide toner market.

Conventional toners have been characterized to assist in the classification of various office copy and laser printer machines. Instrumental techniques, including Fourier transfer infrared (FTIR) spectroscopy, gas chromatography-mass spectrometry (GC-MS) and pyrolysis GC-MS (pyGC-MS) have been used to analyze the polymeric (resin) component of commercial toner formulations, while the particulate (e.g. carbon black) constituents have been examined using scanning electron microscopy (SEM), often in conjunction with energy dispersive x-ray analysis (EDXA). New chemically prepared toners, prepared by various addition and condensation polymerization processes, are affording some extraordinary performance properties. These toners have yet to be well characterized by the scientific community. As manufacturers attempt to “individualize” their products by employing a unique additive or a special particulate morphology, such properties may actually assist the forensic scientist in tracing the toner(s) to a particular manufacturing source and, potentially, to a specific office machine. The objective of this study has been to investigate the expanding gamut of new CPT products and compare them, using FTIR, SEM and other instrumental methods, both with each other and with existing conventional toners, to establish a database for use in forensic casework.

This research will present results from these studies and discuss the practical aspects of employing this information to identify and track toner products on a case-by-case basis.

**Toners, Electrophotography, FTIR**