J16 The Evaluation of Method Parameters Affecting Magnetic Flux Measurement of Toners as a Screening Tool for Casework Application

Carrie Polston, BA, Sam Houston State University, Chemistry and Forensic Science Bldg, 1003 Bowers Boulevard, Box 2525, Huntsville, TX 77341; Williams Mazzella, PhD, University of Lausanne, ESC-IPS, BCH, Lausanne-Dorigny, 0 CH-1015, SWITZERLAND; Martin Furbach, MS, Universite de Lausanne, Ecole des Sciences Criminelles, Le Batochime, Universite de Lausanne, 1015, Lausanne, SWITZERLAND; and Patrick Buzzini, PhD, Sam Houston State University, Chemistry and Forensic Science Bldg, 1003 Bowers Boulevard, Box 2525, Huntsville, TX 77341*

After attending this presentation, attendees will better understand the potential use of a quantitative magnetic flux measuring device to differentiate between black and white toner-printed documents from different sources. Attendees will gain an understanding of the magnetic characteristics exhibited by toner-printed documents and learn how to employ magnetic flux measurement techniques during comparative examinations between questioned and reference printed texts.

This presentation will impact the forensic science community by providing a method for quickly screening black and white toner-printed documents, reducing the need for more time-consuming or destructive methodology.

This study was created to address questions raised by previous research into magnetic properties of toner. Specifically, this research addresses questions related to the optimization of instrumental parameters to maximize repeatability of results and ensure that variability due to the user may be minimized.

Toward this goal, a trial was conducted on seven randomly selected samples from incoming mail collected between April 2007 and January 2016 at the University of Lausanne, Switzerland. A series of three trials were conducted across the span of one week, and a total of 63 magnetic flux measurements were collected from each of three different areas of text per sample. The text areas were selected to include one sample that completely filled the sensor area, one that filled approximately half of the sensor area, and an intermediate sample with an area between the two extremes. The area of each measurement was determined individually using image processing software, and the units were normalized to nWb flux/mm^2 of toner to facilitate comparison.

The primary objective was to determine if the placement of the text within the sensor field affected the precision of measurements. The hypothesis for the experiment based on instrument manuals was that if the text occupied the periphery of the sensor area, there would be distortions in the measurements and the results would become increasingly inaccurate and repeatability would decrease. This is because the sensor is unable to completely image the vector for the magnetic induction of the pixels at the periphery, which leads to inaccurate interpretations of the numerical value for the flux field for those peripheral pixels. The secondary objective was to optimize the protocol for the area determinations. It was determined in a previous study that the mean gray value of the pixels selected appeared to have an impact on reproducibility of measurements. If the standard deviation of the mean gray value was greater than 1 for a sample set, the variance of the results for that sample set appeared to increase. The hypothesis for this linkage was tested by performing the area determinations for the same sample set of interest until the variance for the nWb flux/mm^2 was observed to stabilize at its lowest possible value.

The results of this study indicate that repeatability of magnetic flux measurements of toners can be improved by selecting text areas that do not intersect with the peripheral edges of the sensor and by maintaining a mean gray value standard deviation of .25 or less within the same sample set. This finding is useful to aid in optimizing a method that can be used in a forensic laboratory setting, which will allow for quick screening of toner-printed documents without the need for further testing, which may be destructive.

Questioned Documents, Toner, Magnetic Flux

*Presenting Author