



Criminalistics Section - 2016

B152 Do the Bulk Area and the Exterior Surface of Modern Container Glass Exhibit Differences in Refractive Index (RI) Measurements?

*Joseph Insana**, West Virginia University, Dept of Forensic and Investigative Science, 304 Oglebay Hall, PO Box 6121, Morgantown, WV 26506-6121; and *Patrick Buzzini, PhD*, Sam Houston State University, Chemistry/Forensic Science Bldg, 1003 Bowers Boulevard, Box 2525, Huntsville, TX 77314

After attending this presentation, attendees will better understand the potential differences of RI measurements observed between external surfaces and bulk areas of glass containers. Attendees will also learn about the implementation of a simple and fast method to sample glass fragments from the surface of a glass object.

This presentation will impact the forensic science community, with emphasis to trace evidence examiners, by providing updated information on the potential RI differences that characterize the heterogeneity of this important optical property within modern container glass.

RI is known to be a highly discriminatory property used in forensic comparative examinations of glass. A critical aspect of RI measurements is the evaluation of intra-source variation. Indeed, RI is known to vary at different locations of a given glass object. In addition to spatial heterogeneity, previous studies indicate that differences in RI measurements could be observed between the external surface and the bulk area of a glass object. Considering the improvements of modern glass manufacturing processes, this study compares RI data from the external surfaces of glass containers to those collected from their bulk in order to determine if a significant difference exists.

The objectives of this study were: (1) the development of a method that separates the exterior surface from the internal bulk; (2) to produce representative RI data from the selected glass containers; and, (3) to apply a simple and robust statistic that informs about a potential difference between RI data from the bulk and exterior of a given glass container. This study intends to provide objective information to glass examiners concerned with the understanding of RI variation that could be expected between bulk and external surface for container glass. These results can be valuable when examiners interpret potential differences observed during comparative examinations or when they attempt to explain the dispersion of RI data as a consequence of a sampling method.

The body areas of eight glass containers were selected as initial samples for this study. These were two similar green beer bottles, two similar brown beer bottles, two similar green wine bottles, and two similar colorless honey pots. A novel methodology was developed to isolate the surface layer of glass fragments from their bulk. It consists of a simple and fast approach that scrapes fine glass debris from the surface of a glass fragment. Glass fragments were collected from the body area of the selected containers (as opposed to neck and base). A total of 560 measurements were taken using the traditional method for Glass Refractive Index Measurement based on the joint use of a hot stage and phase contrast microscopy. Fourteen fragments were selected for each container, seven from bulk and seven from exterior. Five RI measurements per fragment were taken for a total of 70 RI measurements per container. Data from the two areas were compared using the Welch version of the Student *t*-test (given the observed differences of variance between the two compared distributions). Differences between bulk and exterior were observed from the body areas of three glass containers out of eight. These differences were observed from glass objects of the same type and manufacturer.

Trace Evidence, Glass, Refractive Index