## A196 Determination of Unique Fracture Patterns in Glass and Glassy Polymers

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After attending this presentation, attendees will gain information on current research in the field of fracture pattern analysis. Particular attention will be given to the uniqueness of each fracture pattern. A statistical treatment of observed data will be presented, together with a discussion of potential error rate and measurement uncertainty.

This research will impact the forensic science community by providing information relevant to the reliability of physical match and fracture pattern interpretation. In particular, the issue of coincidental fracture duplication will be addressed.

Not infrequently, investigators ask if two glass fragments collected from different locations fit together in a manner demonstrating their former adjacency in a now fragmented glass object. Clearly, the evidentiary value of such a fit depends on the reliability of methods that demonstrate the uniqueness of fractured glass surfaces and the physical properties of glass itself. But fracture mechanisms, not uniqueness of fracture patterns, have been the focus of research in the forensic science community. The goal has been to understand such mechanisms and to reveal ways of identifying the fracture mechanism in any given situation. Thus one does not know how unique fracture patterns may be or how reproducible they are.

Also, within the forensic sciences, the uniqueness of fracture margins of glass and other brittle solids has been assumed. While there is empirical evidence of this, there has been little effort to develop a rigorous fundamental basis to support this assumption. Much of the forensic literature dealing with glass and glassy polymer evidence has spoken of the mechanisms of fracture propagation rather than fracture uniqueness. The present work has focused on the issue of uniqueness.

Fractures were initiated using two different methods, velocity impact and static pressure. For the velocity impact method, a drop weight was released at a predetermined velocity to initiate the fractures in glass window panes and glass bottles. Ten of each item was fractured for each of the three interchangeable tips used in the drop weight. The three tips used included a round tip, a sharp tip, and a blunt tip. These three tip types were chosen to determine if the type of surface that impacted the glass had any effect on the fracture pattern.

For the static pressure method, a hydraulic press was used to apply pressure to the glass window panes and glass bottles until fractures were obtained. Again, ten of each item was fractured for each of the three tips used in the hydraulic press. The round, sharp, and blunt tip types were again used to determine if the type of surface that impacted the glass had any effect on the fracture pattern. Once all fracture experiments were complete, the fracture patterns were converted to digital images and an inter-comparison analysis was completed to determine the uniqueness of each fracture pattern.

It was found that in an inter-comparison of the sixty glass window pane fractures, none of the 3,600 comparisons were determined to be duplicate fracture patterns. In an inter-comparison of the sixty glass bottle fractures, it was also determined that none of the 3,600 comparisons were found to be duplicate fracture patterns.

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**Glass Fracture, Physical Match, Fracture Pattern**