D30 Effects of Corrosive Environments on Fractured Surfaces of Stainless Steel Knives

James F. Evans, 211 Northcrest R, Angola, IN 46703; and Stacie Johnson, Ames Laboratory, 5 Spedding Hall, Ames, IA 50011-3020*

After attending this presentation, attendees will be informed of the effects real-life situations may have on the fractured surface of a stainless steel knife; for example, the tip of the knife being left behind at the scene, exposed to the elements, left soaking in the victim's blood, and if the hilt of the knife was discarded in a lake or river, or was cleaned with common household cleaning agents.

This presentation will impact the forensic science community by providing effects of different environments and conditions for which evidence can be found on stainless steel knifes, an ongoing project examining several different materials, such as metals, ceramics, polymers, adhesive tapes, and paper.

Thirty-nine Chicago Cutlery stainless steel steak knives were broken using the same load mechanism leaving 39 tips and 39 hilts. Each sample was then weighed and randomized. Using the Analysis, Comparison, Evaluation, and Verification (ACE+V) method of fracture match, each tip was correctly identified and matched to its corresponding hilt. Nine samples were then exposed to blood; three for one week, three for two weeks, and three for three weeks. Nine samples were exposed to a 3.5% solution of saltwater for the same intervals. Three samples were briefly dipped in bleach and three briefly dipped in ethanol and allowed to air dry. Three samples were soaked in a 50% solution of bleach, three in a 50% ethanol solution, three in a concentrated bleach solution, and three in a concentrated ethanol solution, each for two weeks. Three control samples as well as the other half of each of the exposed samples were not exposed. All samples were stored at room temperature during exposure. After exposure, each sample was cleaned, allowed to dry, and reweighed. The ACE+V method of fracture match was used again to attempt to identify the exposed samples to their other half.

Blood samples showed zero sign of degradation and no significant loss of mass after three weeks of exposure. Saltwater samples showed visual signs of oxidation on the side of the sample within just a few hours, but none of the samples showed degradation on the fracture surface. After three weeks of exposure, they experienced an average loss of mass of 0.25%. All blood and saltwater samples were correctly identified using the ACE+V method of fracture match. None of the ethanol samples showed any visual sign of degradation nor did they experience any change in mass. One sample, however, was rendered an inconclusive result during matching using the ACE+V method. The three dip-and-dry bleach samples showed neither degradation nor any change in mass. The samples in the 50% solution of bleach showed a 3.26% increase in mass due to oxidation while the samples in the concentrated solution experienced an 8.47% increase in mass. One of the samples in the concentrated solution was yielded an inconclusive result using the ACE+V method. All other samples were correctly identified.

In order to address the recommendation expressed by the National Academy of Sciences, this project sought to provide preliminary investigation on the impact of different environments and conditions for which evidence can be found. This is an ongoing project examining several different materials including, but not limited to, additional metals, ceramics, polymers, adhesive tapes, and paper.

Work at the Ames Laboratory was supported by the U.S. Department of Energy Science Undergraduate Laboratory Internship (SULI) Program under its contract with Iowa State University, Contract No. DE-AC02-07CH11358. This research project was also partially funded by the U.S. Department of Justice, National Institute of Justice at Ames Laboratory, under Interagency Agreement number 2011-DN-R-0230.

Fracture, Corrosion, Steel

 ** Presenting Author*