C46 Estimation of TASER® ECD Discharge Duration Based on Surface Morphology Changes

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After attending this presentation, the attendees will become familiar with analysis techniques that could be used in forensics investigation to correlate the physical evidence to the electrical activity of the Taser ECD. It will become apparent that the changes in surface morphology (physical evidence) indicate the duration of discharge of a Taser ECD.

This presentation will impact the forensic science community by providing a means to analyze and interpret physical evidence that investigators in the past may have neglected to analyze and correlate it to actions taken during an event where a Taser ECD was used. Electrical arcing creates changes in surface morphology that could be used in forensics analysis. This novel approach uses changes in surface appearance and its morphology to estimate the duration of ECD. i.e., it uses physical evidence that was formed by discharging Taser ECD to relate it to discharge duration.

TASER Electronic Control Devices (ECD) are used commonly for self defense and for law enforcement. An ECD is designed to deliver electric current to a subject's body with the purpose of temporarily incapacitating an individual. Activation of the ECD's trigger delivers a burst of energy at the output and to the subject. For example, a TASER X26® ECD is rated to deliver a 1,200 V pulse at the rate of approximately 19 pulses a second (each pulse lasting approximately less than 150 microseconds). The energy flows into the subject's body through the insulated wires and metal probes that penetrate the skin or adhere to the clothing of the subject. The attachment method between the wires and the metal probes creates an air gap between the wire tip and the metal probe's body that must be bridged on both probes to complete and then maintain the electrical circuit. Due to the high voltage pulse, the air gap is bridged by an electrical arc which develops between the wire tip and the metal probe's body. This arcing activity results in visible changes to the wire tip and the metal probe's surface exposed to the arcing. Such surface morphology changes can be useful as physical evidence that may indicate the ECD discharge duration.

ECD discharge tests were performed for a number of time durations. A minimum of three tests were conducted for each discharge duration using two probes connected to a 600 Ohm (Ω) resistor. The metal probe surfaces exposed to electrical arcing during the tests were then analyzed using scanning electron microscopy (SEM) and surface profilometry to determine the correlation between the surface morphology changes and the ECD discharge duration.

SEM analysis indicated that the exposed probe surface appeared visibly more damaged with an increase in the ECD discharge duration. In addition, surface profilometry analysis indicated that the volume of expunged material from the exposed probe area became greater with an increase in ECD discharge time. The preliminary investigation suggests that the changes in surface morphology are a function of the ECD discharge duration. This correlation of the physical evidence with the ECD discharge time can be established by using a combination of SEM and surface profilometry analyses and may become a valuable tool in forensic investigations where the time of ECD discharge is an unknown and a potentially disputed fact.

Duration of Taser ECD Exposure, Probe Surface Morphology, Surface Profilometry

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