1648
doi:10.1017/S1431927621006073
Microsc. Microanal. 27 (Suppl 1), 2021

Can an iPhone save your life? Multimodal forensic analysis of bullet damage to a smartphone

Wesley De Boever[1], Jack Mershon[2], Dean Miller[2] and Luke Hunter[2]

[1]Tescan, Belgium, [2]Tescan, United States

In today's connected society, we never leave home without our smartphone. In this experiment, we investigated if our trusty companion could actually save us from a bullet impact.

Combining several state-of-the-art 2D and 3D microscopy methods, the damage inflicted to an iPhone 6 shot at point blank range by a .22 caliber revolver, was examined.

In the study, we utilized wide-field SEM images, acquired using a TESCAN VEGA SEM, to get an overview of the complete surface of the phone, before and after bullet impact. This distortion-free images provide a detailed view of the exterior of the device, before examining certain areas in more detail.

The first areas of interest are the entrance and exit cones of the bullet. The front side of the examined cell phone shows a large hole, surrounded by a concentric cracking pattern originating from the point of impact. Automatic high-resolution panorama stitching of the hole and its surroundings, enable a very detailed investigation of the bullet's impact point (figure 1).

Although the phone's back side suffered a lot of damage and deformation, the bullet was indeed stopped by the phone, and one could indeed say that an iPhone can save your life!

By using anaglyph images – created by imaging the same field of view from different angle – a digital elevation model (DEM) of the phone's surface structures can be created. Although these surface models are very helpful to investigate certain parameters such as the effects of the impact or the bullet trajectory, no information can be obtained on the internal damage caused by the projectile.

Therefore, micro-computed tomography (micro-CT) was performed in the TESCAN UniTOM XL, to locate the different bullet fragments in the interior of the device. Results show that the largest fragment almost made it through, but was ultimately stopped by the battery and a metal plate behind it. The 3D tomography information shows the damage to the anode and cathode layers inside the lithium-ion battery, and several fragments of the bullet scattered throughout the phone (figure 1).

Finally, EDS analysis of glass fragments found near the crime scene, can be used to distinguish ordinary glass from chemically hardened smartphone glass. We can demonstrate the presence of a transition from a sodium to potassium-rich glass phase, typically caused by the production process of scratch- and impact-resistant glass.

In this work, we have shown that by using a combination of well-established and novel electron and X-ray imaging techniques, a detailed observation can be made of objects found at a crime scene. Different imaging modalities all have their strengths and limitations, and by combining all methods at hands, all clues can be connected, hopefully leading to one single solution.

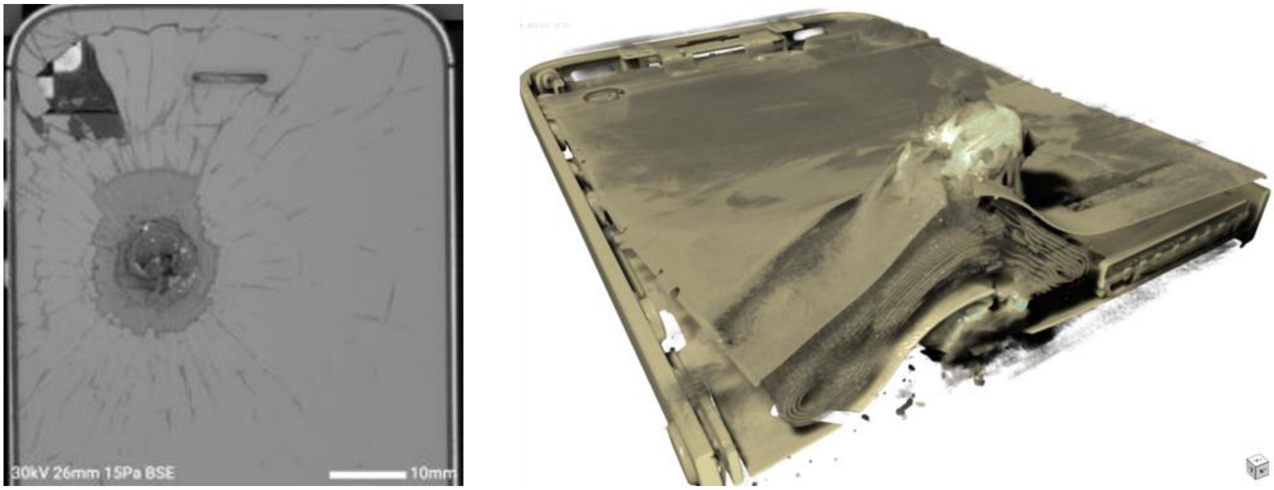

Figure 1. Left: High-resolution stitched panoramic image of the iPhone's front surface. Right: internal damage caused by the bullet.

https://doi.org/10.1017/S1431927621006073 Published online by Cambridge University Press