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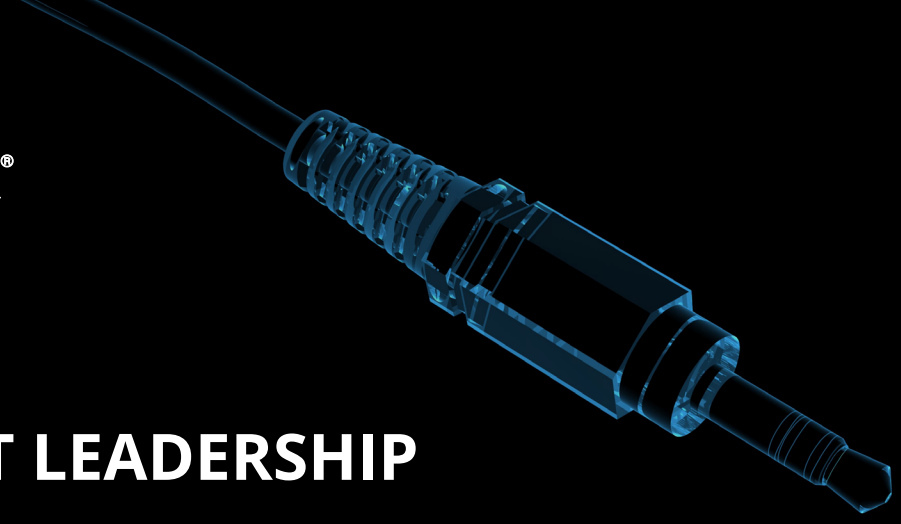

THOUGHT LEADERSHIP

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Use of Non-Destructive Computed Tomography for Litigation and Quality Control Investigations

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Benefits of Non-Destructive Investigation

Non-destructive investigation refers to a group of techniques used to evaluate a material, product, or device without affecting the integrity of the unit being examined. One of the most powerful non-destructive investigation techniques available today is three-dimensional X-ray microcomputed tomography (µCT). µCT creates a 3D digital replica that investigators can examine at high magnification without introducing contaminants, altering the device, or causing any loss of information. Manufacturers across a multitude of industries, including consumer electronics, medical devices, and batteries, can use µCT imaging to conduct proactive, non-invasive assessments of designs or concepts before market launch. In a litigation context, manufacturers can also use µCT imaging to perform non-destructive failure analysis investigations. Both use cases, when lead by technology and industry experts, can help manufacturers make informed, timely, and cost-effective decisions about their products.

High Resolution Quality Control

In industry, µCT imaging is experiencing rapid adoption in quality control. Manufacturers can use µCT imaging to examine a multitude of internal components at high magnification and obtain quantifiable information on part variability, defects, sizes, pores, and more. Many manual quality control processes are restricted to the 200-micron resolution of the human eye, but depending on the evaluated device, Exponent's µCT imaging technology can scan at a 1-micron or sub-micron resolution. This length scale enables us to easily identify misaligned parts or voids inside a sample that could pose quality risks. Within minutes, and with minimal risk of information loss, manufacturers can assess adherence to quality standards and identify risks before a new product is launched.

Evidence Preservation in Litigation

In recent years, legal firms have increasingly recognized the potential of µCT imaging to evaluate evidence with minimal risk of contamination or alteration. Our team at Exponent recently partnered with a law firm to investigate whether or not a piece of burned plastic had been manufactured by the firm's client. Due to heat-induced deformation, this seemingly simple question was actually difficult to answer without destroying evidence. Using µCT imaging, our team was able to examine the molten piece of plastic and identify the serial number present on an internal component. This analysis enabled us to definitively answer the law firm's question with minimal handling and contamination risk to the evidence. Our team regularly conducts similar investigations for batteries that have experienced thermal events and medical devices that have failed in situ. In each of these analyses, µCT imaging has provided valuable information at a time saving compared to more traditional investigation techniques. When necessary, µCT imaging has also enabled us to reproduce accurate 3D-printed replicas of the items under investigation.

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Potential Limitations

Like all analytical techniques, the use of µCT imaging technology for non-destructive investigation has its limitations. Because there is an inverse relationship between the area to be scanned and the scanning resolution, µCT imaging is often challenged to accurately visualize small features within large objects. For example, it is difficult to examine a full automobile engine at a 1-micron resolution. In addition, because µCT imaging technology is x-ray based, it is only suitable for objects that interact well with X-rays. This excludes lead-based materials and exceptionally large metal objects. Finally, unlike medical CAT scans, µCT imaging technology is not suited for human use.

Exponent's Expertise

Exponent's multidisciplinary team includes experts in µCT imaging who are also leaders in mechanical and electrical engineering, battery technology, medical devices, and polymer science, among many other disciplines. We can help manufacturers across a multitude of industries leverage non-destructive investigation techniques to obtain valuable insights to inform their business needs.

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