

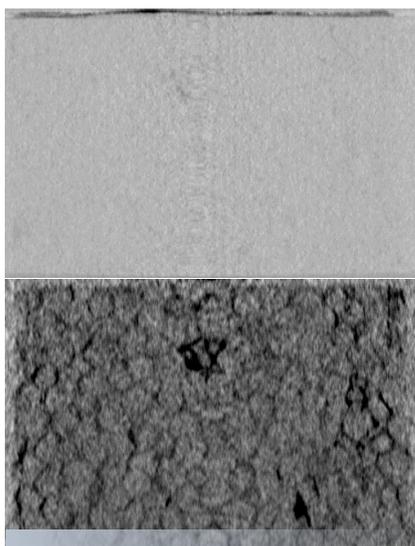
LARGE FIELD OF VIEW, 3D X-RAY PHASE CONTRAST IMAGING SYSTEM

Patents Pending

Technology Readiness Level: 4/5

Key elements demonstrated in laboratory or relevant environment

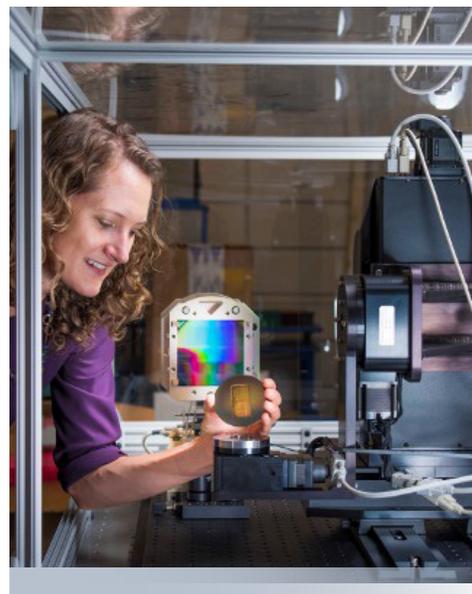
Sandia National Laboratories has developed a high-sensitivity X-ray Phase Contrast Imaging (XPCI) system that provides a method for non-destructive 2D digital radiography and 3D tomography of low-density composite materials. Non-destructive evaluation and inspection is essential to establishing confidence in the functionality and security of a variety of components. Many of these parts contain low-density encapsulants to protect components from shock, thermal fluctuations, and high voltage breakdown. Sandia's XPCI system incorporates unparalleled grating technology, which enables identification of defects in low-density materials that are usually transparent or indistinct using traditional X-ray imaging.



3D imaging of foam on Sandia's XPCI system. **Top:** Absorption (foam is nearly transparent to x-rays); **Bottom:** Dark-Field (the cellular structure and its defects are apparent in the foam)

Sandia utilizes an innovative semiconductor manufacturing process that combines Bosch deep reactive ion etching (DRIE), atomic layer deposition (ALD), and pulse gold electroplating to create higher aspect ratio gratings with better uniformity and larger surface area—increasing field of view and sensitivity over the current state-of-the-art. This novel grating technology enabled the creation of a compact, bench-scale XPCI device with the ability to detect cracks, voids, or delamination in low density materials. Sandia's XPCI system enables non-destructive inspection throughout the assembly process—improving overall confidence in part reliability. Sandia has also demonstrated advanced image processing techniques that enable extraction of features in low density materials in proximity to high density components such as foam microstructure in the presence of high-Z structures (e.g., wires).

This novel XPCI system will increase confidence in components used in high consequence national security systems and has potential impact on medical imaging, homeland security, building and material safety, transportation safety, and food safety inspections.



TECHNICAL BENEFITS

- Large field of view
- Capable of 2D digital radiography and 3D tomography
- Benchtop system
- Improved sensitivity and defect detection in low density materials
- Reduced costs by identifying defects early

INDUSTRIES & APPLICATIONS

- Non-destructive inspection
- Aging and state characterization
- Medical imaging
- Food safety inspections

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