Skysong Innovations
Advancing the Arizona State University Knowledge Enterprise

1475 N. Scottsdale Road, Suite 200
Scottsdale, AZ 85287-3538
Phone: 480 884 1996 Fax: 480 884 1984

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Inventors

Nikhilesh Chawla

Jason Williams

James Mertens

Contact

Shen Yan
shen.yan@skysonginnovations.com

Modular High Resolution X-Ray Tomography System: Source, Sample Manipulation, Detector

High resolution x-ray tomography (XCT) provides a nondestructive approach to 3D imaging suitable for examining material microstructures. Current options for x-ray micro-tomography (μXCT) are limited to select research facilities that employ synchrotron light sources in XCT experiments, and overpriced lab-scale μXCT systems of insufficient versatility. Few in number and costly to operate, synchrotron facilities are in constant demand and are profoundly expensive. Commercially available μXCT systems lack a customizable design that would otherwise facilitate their ability to alter empirical conditions or optimize scanning resolution, crippling experimental control and flexibility.

Researchers at ASU have created a modular, high resolution x-ray tomography device designed for component and sample modification. Lens magnification, lens aperture, and scintillator composition, thickness, and area are all customizable, as well as x-ray reflection, transmission, trajectory, and shielding. There is also a custom x-ray cradle that allows sources to be switched while maintaining beam trajectory. The prototype handles samples ranging from 2cm down to tens of microns that are composed of metal alloys (including Pb, Sn, Fe, Cu and Al), ceramics, and polymeric composites. A wide range of x-ray magnification maximizes flux through the sample, optimizing field-of-view and reducing scan time, and produces an image with resolution of 1 micrometer or less given any voxel size. Additionally, the system adapts to nearly any component that might be needed for future research needs or technologies, extending the lifetime of the device.

Potential Applications

- Injection Molding
- Materials Science
- Micro Mechanics
- Semiconductor Characterization

Benefits and Advantages

- Capability – Reduced scan time, high spatial resolution, and a wide range of sample sizes and materials.
- Modularity – System flexibility for altering experiential conditions and optimizing performance.
- Lower Cost – Considerably more economical than synchrotron facilities and more reasonably priced than current bench-top equipment.
- Versatility – Customizable design integrates well with a variety of components.

For more information about the inventor(s) and their research, please see Dr. Nikhilesh Chawla's directory webpage

Dr. Jason Williams' directory webpage