

COMPARISON AND APPLICATION OF CONFOCAL MICRO X-RAY FLUORESCENCE AND MICRO X-RAY COMPUTED TOMOGRAPHY TO MATERIALS CHARACTERIZATION.

Brian M. Patterson and George J. Havrilla
Los Alamos National Laboratory, Los Alamos, NM 87545

Bench top confocal micro x-ray fluorescence (CMXRF) offers a new paradigm in materials characterization. A 3D confocal volume, created by overlapping the focus of the excitation and detector optics make it possible to non-destructively map out, voxel-by-voxel the elemental distribution of a sample based upon the x-ray fluorescence. The current instrument has a probe size of 30 x 30 x 60 micrometers which can be stepped in all three directions to collect elemental and density data at every single point. The current instrument configuration allows elemental mapping from Ca to Pu.

Micro X-ray Computed Tomography (MCT) is a complementary non-destructive technique to CMXRF. A series of transmission radiographs are collected as a sample is rotated. These radiographs are then used to reconstruct the 3D physical structure of the sample based upon the attenuation of the x-rays. Current instrumentation has a spatial resolution of approximately 1.4 μm in all three directions.

In this presentation, comparisons including advantages and disadvantages of each technique as well as complementary strengths will be highlighted. A data acquisition scenario involves using MCT to collect high resolution structural images and CMXRF to locate and identify elemental distributions. This approach provides a more comprehensive characterization of the sample both in physical structure and elemental composition. These techniques have been useful for a variety of materials including thin films and coatings, low density materials such as foams, as well as defect analysis.