Energy-Dispersive Diffraction Imaging Using a New Germanium Strip Detector

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Based on the energy-dispersive diffraction (EDD) geometry, we present a method to rapidly collect data for tomographic reconstruction of crystalline material samples that provides a cross-sectional crystallographic phase map. This work reports on tomographic reconstruction with a polychromatic radiation source and an energy-dispersive x-ray detector array being developed through a collaborative effort between Brookhaven National Laboratory and Argonne National Laboratory. Fabricated using a germanium sensor, a one-dimensional array with 64 elements has been assembled and tested for use with the EDD technique. Results of EDD imaging are presented for two samples containing hydroxyapatite (hAp). The first is a 3D-printed sample with an elliptical cross-section and contains synthetic hAp. The second is a human second metacarpal bone from the Roman-era cemetery at Ancaster, UK and contains bio-hAp. Reconstructions with different diffraction peaks are compared. Prospects for future EDD imaging are also discussed.