Dr. Niven Monsegue
Research Associate
Materials Science & Engineering & ICTAS
Virginia Tech

“Three-dimensional Materials Science by Electron Microscopy”

Abstract

Electron tomography (3D transmission electron microscopy) is a useful technique for recovering lost spatial information in electron micrographs, and has been developed over the last two decades. However, the process for generating a three-dimensional reconstruction of an area of interest (tomogram) through electron tomography usually requires the acquisition of more than one hundred images. As a result, significant electron beam damage may occur in samples being studied. In this seminar, a new reconstruction technique called Compressed Sensing (CS) will be presented. This novel reconstruction technique we have recently developed is aimed for reducing the number of images required for 3D reconstruction without significant degradation to a tomogram’s quality. In addition, we have found that this technique improves the accuracy of dimension determination at the nanometer scale.

Qualitatively, electron tomography offers greater insight into the morphology of a variety of materials compared to traditional electron micrographs. These materials include catalyst, minerals, bacteria, and polymers. However, electron tomography’s greatest strength is in its ability to quantitatively characterize materials in three-dimensions. Size, shape, and distribution of features in materials are more accurately measured using electron tomography. Both qualitative and quantitative applications of electron tomography will be presented and discussed.

Biosketch

Niven Monsegue graduated from Morgan State University (2005) with a B.S. degree in Engineering Physics. He then obtained his M.S. (2008) and PhD (2010) degrees in Materials Science and Engineering from Virginia Tech. Currently he works as a Research Associate in the MSE department at Virginia Tech in the field of electron microscopy.