APPLICATION OF ACCELERATORS IN NANOMATERIALS RESEARCH

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To streamline the US government support in advancing nanoscience research, Department of Energy's Office of Science established five Nanoscale Science Research Centers (NSRCs) in 2006 at DOE's six national laboratories: Center for Nanoscale Materials (CNM) at Argonne National Laboratory (ANL); Center for Functional Nanomaterials (CFN) at Brookhaven National Laboratory (BNL); Molecular Foundry (The Foundry) at Lawrence Berkeley National Laboratory (LBNL); Center for Nanophase Materials Science (CNMS) at Oak Ridge National Laboratory (ORNL); and Center for Integrated Nanotechnologies (CINT) jointly operated by Los Alamos National Laboratory (LANL) and Sandia National Laboratories (SNL). While all NSRCs have common capabilities such as electron microscopy to support users, each NSRC also has its distinctive capabilities and uniquely focused research areas. One of the unique research areas at CINT is its ion beam materials research leveraging two accelerator laboratories: Ion Beam Materials Laboratory (IBML) at LANL and Ion Beam Laboratory (IBL) at SNL. The CINT ion beam capabilities cover broad beam energies ranging from tens of eV to over 100 MeV using 11 accelerators/implanters equipped with a variety of ion sources and 25 beamlines/endstations. The beam size can be focused as small as 10 nm on 35 kV Raith Velion Nanoimplanter or rastered as large as 200 mm wafer size on 200 kV Danfysik Research Implanter. Besides traditional single ion beam research such as ion beam analysis, ion beam modification, and radiation effects, coupled beamlines are developed to simulate reactor extremes and support actinide research. In addition, transmission electron microscopy (TEM) and positron annihilation spectroscopy (PAS) are coupled to ion irradiation beamlines to perform in situ defect characterizations. This talk will highlight recent advances in ion beam nanomaterials research ranging from layer-tuneable graphene synthesis, controlled helium confinement through novel metal nanolayers, to new in-situ corrosion monitoring during irradiation based on particle induced X-ray emission (PIXE).

This work was performed, in part, at the Center for Integrated Nanotechnologies, an Office of Science User Facility operated for the U.S. Department of Energy (DOE) Office of Science. Los Alamos National Laboratory, an affirmative action equal opportunity employer, is managed by Triad National Security, LLC for the U.S. Department of Energy's NNSA, under contract 89233218CNA000001.