Materials grown in the AKR group

Library of Materials grown by AKR group (along with BG group)

1. Nanoparticles of ZnO, Manganites, Titanates , Nickelates, Cobaltates, Gold and Silver.
2. Nanowires of FCC metals, Zn, ZnO,WO_3, Manganites and Nickelates and TiO_2.
3. Nanowires of Si and Ge
4. Nanowires of TTF-TCNQ and Cu-TCNQ
5. Epitaxial films and multilayers of Oxides like ZnO, Manganites, Titanates and Nickelates on single crystalline substrates.
6. Nanostructured films of different materials.

AKR group has extensive activities in the area of materials growth . This involve various methods to grow nanowires and nanoparticles as well as growth of epitaxial thin film using pulsed laser deposition and chemically grown nano and microcrystals of organic materials. . The materials grown encompass a large class of materials like metal nanowires, binary and complex oxide films, nanoparticles and nanowires, Charge transfer complex nanowires and microcrystals and elemental semiconductor (Si and Ge) nanowires. As a special capability of the group the nano wires grown are integrated with nanolithgography for making measurements at the level of single nanowire. In these activities the group has strong collaboration with and participation of the group of Dr.Barnali Ghosh (Saha)

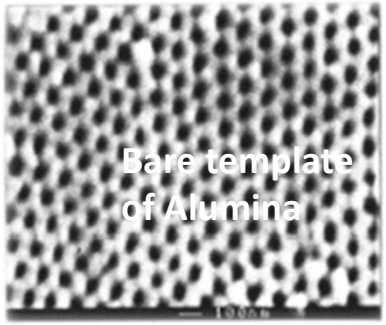
The nanoparticles are mostly grown by sol-gel or chemical solution deposition techniques or by a Laser ablation method.. The nanowires of metal are grown by electro deposition within an anodized alumina(AAO) nanoporous templates down to a diameter of 15nm. The oxide nanowires are grown by chemical methods within pores of the AAO template or by Hydrothermal method in an Autoclave. Some of the oxide nanowires are also grown by PLD. Elemental semiconducotr nanowires (like that of Si and Ge) are grown by Vapour phase method in a multizone furnace on to a cold substrate with a suitable carrier gas using Au nanoparticles as catalyst. Charge Transfer Complex nanowires are grown by vapour phase as well as by solution method. Nanoparticles of metals like Au can also grown by physical method like dewetting a thin film grown on a Si substrate and also by direct Laser ablation of a Au target in a liquid like water or Polyethylene Gycol.

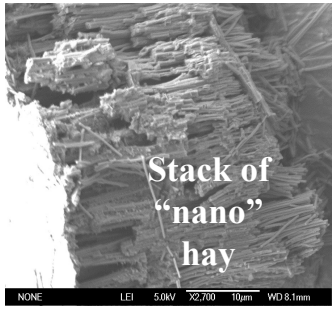
Pulsed Laser Deposition (PLD) using an excimer laser (KrF) is used to grow epitaxial films and multilyares on single crystalline substrates like Sapphire (Al_2O_3), TiO_2, NGO, LAO and STO. Often a RHHED gun equipped chamber is used to grow films on a terraced substrate.

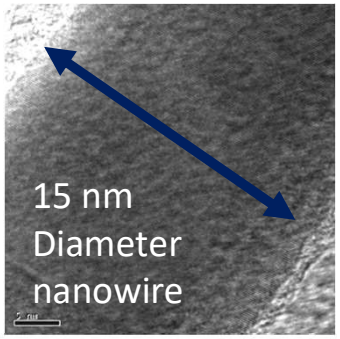
Fabrication of nanowires

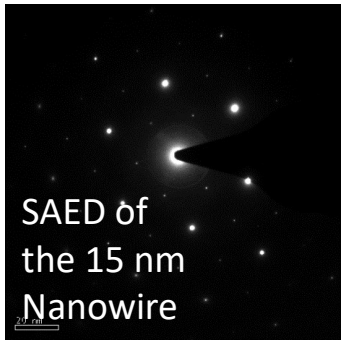
Metals, semiconductors, molecular materials and complex oxides….

Template assisted Electro-deposition of metal nanowires

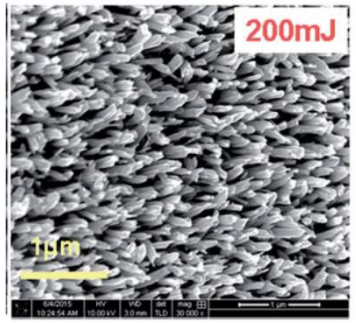




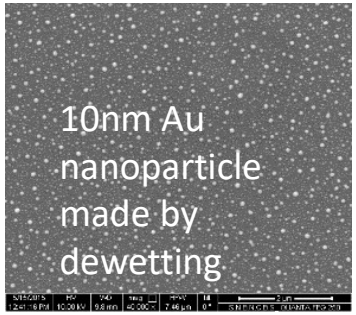


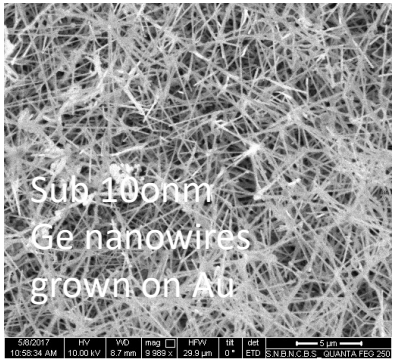


Physical Vapor Deposition of molecular materials nanowires



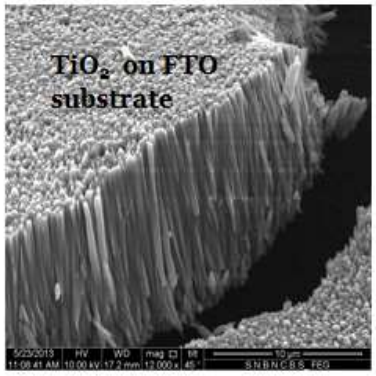
Pulsed Laser Deposition of Oxide nanowire array



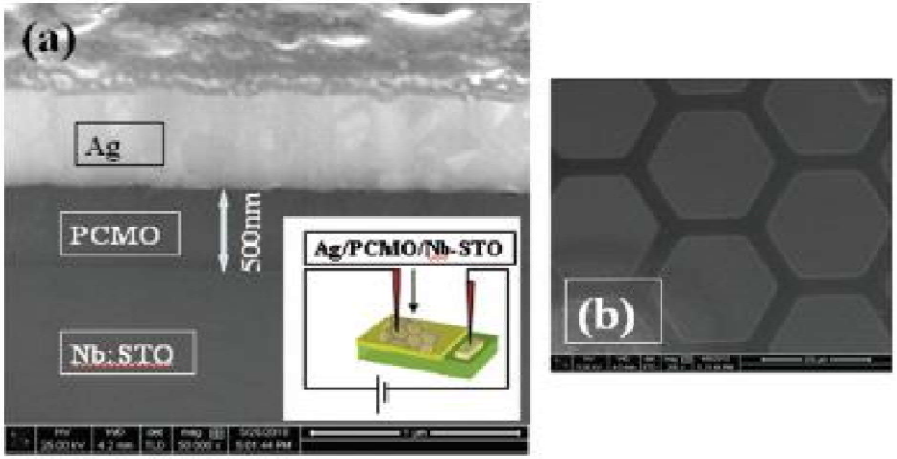


Vapor transport growth of Ge nanowires on Au catalyst

Dense array of TiO_2 nanowires grown by Hydrothermal growth on FTO substrate



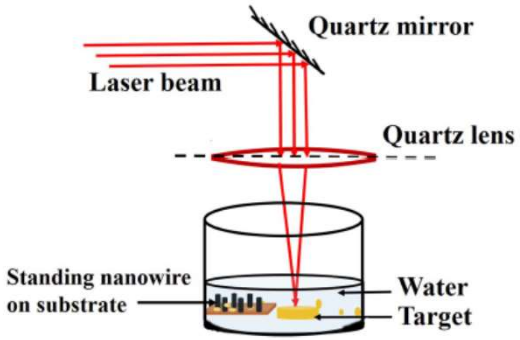
Fabrication of epitaxial films and devices using pulsed laser ablation

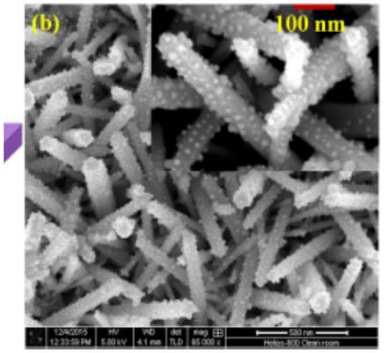


Junction of Ag/PCMO/NbSTO multilayer film grown by PLD and then covered with patterned. Ag pads

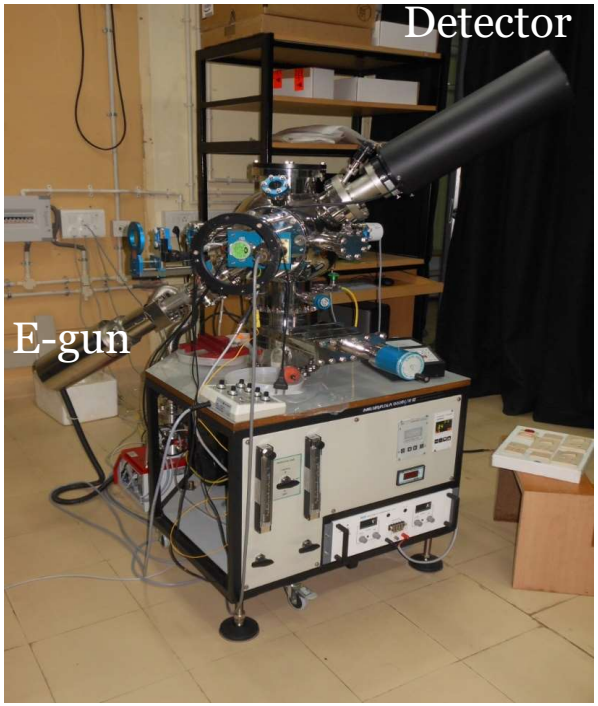
Fabrication of nanoparticles using laser ablation from a target in a liquid medium

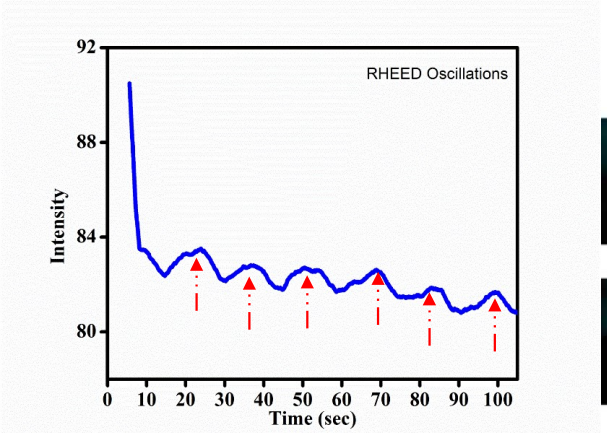
Au Nanoparticles, fabricated by laser ablation from Au target in water used to attached them without any logand to ZnO nanowires



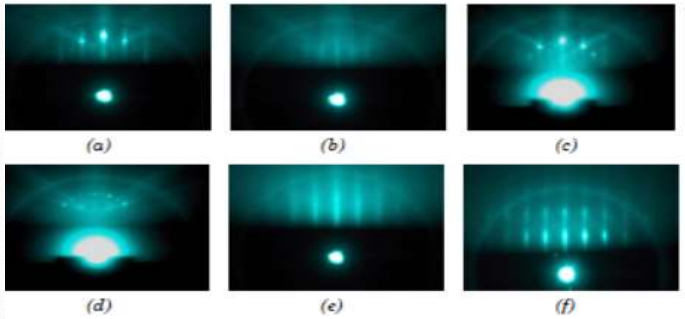


Film growth on terraced substrate and study growth by RHEED



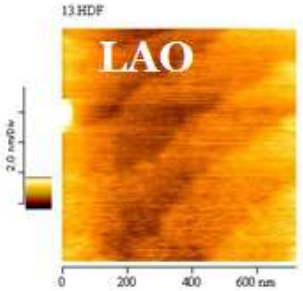


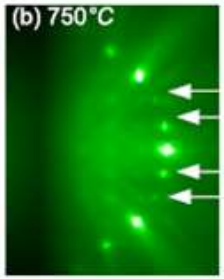
Epitaxial growth probed by RHEED



6 UC film of $NdNiO_3$ grown on STO
Each layer is 0.38 nm
Total film thickness ≈ 2.17 nm

Atomic size step and terraces (width 200-500nm) made on substrates by chemical etching and vacuum/O_2 annealing





RHEED pattern