Modern materials

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Ultra fine grained and nanocrystalline materials belong to an important group of modern materials with unusual properties that are very attractive for different structural and functional applications. Modern techniques of preparation of these materials are based on the imposition of very high strains leading to exceptional grain refinement without any significant change of the overall dimensions. High hydrostatic pressures are applied during these processes which introduce high densities of lattice defects (e.g. dislocations or vacancies) and result in the formation of special structures. Materials fabricated by these techniques, called severe plastic deformation, exhibit several unique properties including very high strength, ductility and fatigue endurance, increased superplastic capabilities as well as multifunctional behaviour when materials exhibit enhanced functional (electric, magnetic, corrosion, etc.) and mechanical properties.
For several years we have been dealing with structure investigations of various types of nanostructures (semiconductor quantum wires dots, metallic nanoparticles, etc.) using x-ray based methods such as x-ray diffraction, small-angle x-ray scattering and x-ray absorption spectroscopy. Several years ago we have started a study of the structure of new materials, like antiferromagnetic semiconductor layers and topological insulators. We perform the experiments in the x ray lab of the Department of Condensed Matter physics. Moreover, we are frequently using various synchrotron and neutron sources – ESRF and ILL (Grenoble), ANKA (Karlsruhe), ELETTRA (Trieste), APT (Argonne Nat. Lab.), PSI (Villingen), etc.

Selected outputs

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