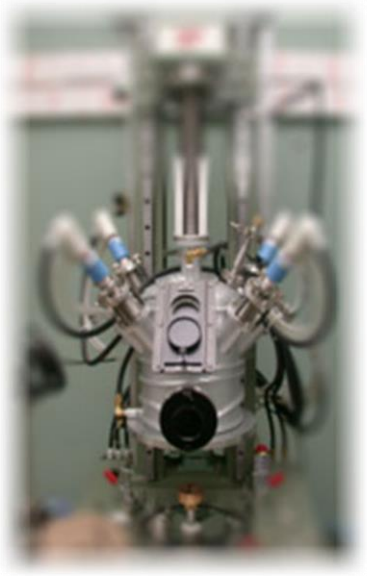
Crystal Growth Laboratory



Tetra-arc furnace to grow single crystals by Czochralski method

Welcome to Crystal Growth lab

The main theme of the crystal growth lab is to grow the single crystals and study the anisotorpic physical properties of strongly correlated electron systems (SCES). The single crystals are grown by employing different crystal growth techniques like Czochralski method, Bridgman method, high temperature solution growth and vapor transport methods. The grown crystals are oriented along the crystallographic directions by means of Laue diffraction and cut along the crystallographic directions by means of spark erosion cutting machine for the anisotropic physical property measurements.

Tools & Techniques

Single crystals are grown using a variety of methods. A tetra-arc furnace and an optical floating zone furnace are the main work horses to grow single crystals by Czochrlaski and floating zone methods apart from the usual box type furnaces to grow single crystals by flux method. A Laue diffractometer to orient the single crystals. A physical property measurement systems (PPMS) with a 14-T magnet to measure specific heat capacity and electrical resistivity down to 50 mK using the dilution insert.

CURRENT MEMBERS:

Prof. S. K. Dhar and Prof. A. Thamizhavel; Ms. Ruta Kulkarni, Mr. Arvind Maurya, Dr. Arvind yogi and Dr. Md. Matin

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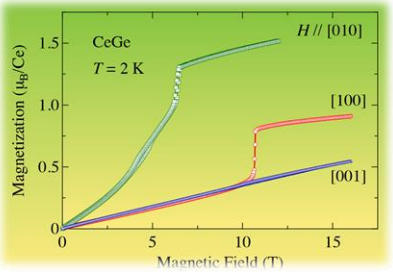
Strongly correlated electron system (SCES)

In some of the intermetallic compounds, the conduction electrons interact very strongly with the magnetic atoms present in the system and hence the magnetic ordering of the magnetic atoms is suppressed and the magnetic character of the atoms is *dragged* along or hybridized with the conduction electrons. Such types of systems are classified as SCES. The competition between the long range magnetic order and the itinerancy of the electrons on the magnetic atoms leads to diverse ground states. Ce and Yb-based intermetallic compounds are studied quite extensively by growing the single crystals of these compounds.

Quantum Phase Transition

The magnetic phase transition occurring at finite temperature of the SCES of mainly cerium or ytterbium compounds can be continuously tuned from a magnetically ordered state to a non-magnetic ground state by a non-thermal external control parameters such as high pressure, composition or magnetic field. For a critical value of the control parameter, the magnetic phase transition approaches a T = 0 phase transition or the so called quantum phase transition (QPT) which separates a magnetically ordered from a non-magnetic ground state at zero temperature. One of the objectives of this laboratory is to look for such materials that exhibit QPT.

Czochralski crystal growth in a tetra-arc furnace.



Anisotropic magnetization in CeGe single crystal. The [010] direction represents the easy axis of magnetization