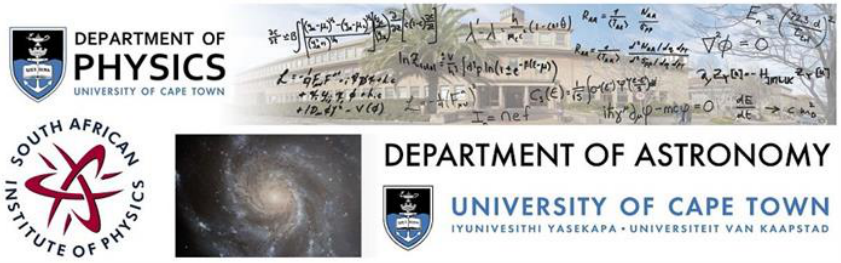

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Development of Metal-flux based Crystal-growth Facility

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Abstract content
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Single crystals are solids in which the atoms/molecules are arranged in such way that the lattice periodicity is extended uninterruptedly till the edge of the materials. The advancement of micro-electronics research, laser-technology and solid state device research is due to the development in crystal growth technology. Among various growth methods, melt flux crystal growth technique is employed extensively for discovery of new materials owing to their diffusivity power, wide range of applicability and low equipment costs. We will present the detailed report of our single crystal growth facility by focusing on the physio-chemical process involved with metallic-flux technique, working principles of various experimental processes and optimization of the growth conditions for some cage compounds. Flux method is a crystal growth technique where the constituent elements are dissolved in a reactive metallic-solvent (Flux). Low melting point metals Sn, Ga, Bi, Al or Sb are used as solvent. The flux serves as a medium for the constituent elements to dissolve either completely or partially. The flux can act as a transporting medium which dissolves one component at particular place and grows the product at another location. The nucleation, reaction kinetics, and dimensions can be controlled by: flux:charge ratio, cooling-rate, homogenization conditions. The inert atmosphere and temperature stability are two essential requirements for synthesizing high quality single crystals. To provide inert atmosphere Alumina crucibles are placed in a quartz tube and evacuated to the pressure of 10⁻⁶ mbar before closing the tube under vacuum. The mixture is heated at 1000-1200 ° C for 24 hrs using a Carbolite Box furnace and then the temperature is reduced close to the melting of the flux in 2-3 temperature segments. At that temperature the tube is removed from the furnace and placed in one of the arms of a low speed centrifuge to remove the flux.

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