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Title:	Investigation of transition metal dichalcogenide based Layered superconductors
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Abstract:	The discovery of superconductivity in 1911 by Heike Kamerlingh Onnes is one of the most significant foundations of science that leads to a number of groundbreaking research in the field of condensed matter physics. Superconductors are highly fascinating due to their exotic properties like perfect conductivity and perfect diamagnetism, and their potential for wide range applications. Discovery of super- conductivity in new materials has always been subject of interest among the material scientists. Several materials are investigated to demonstrate superconductivity, of which the cuprates, iron oxipnictides and transition metal dichalcogenides are most studied systems for last few decades. Recently, a new class of $MTCh_2$ (M: Metal, T: Transition metal, Ch: Chalcogen element with M 6 = T) type intercalated transition metal dichalcogenide based layered superconductors like $PbTaSe_2$, $SnTaS_2$ and $PbTaS_2$ has re-established the interest in these systems. These materials apart from being superconducting also possess nontrivial topological electronic band structure that makes them strong candidates to realize novel quantum states like topological superconductors and Majorana fermions. In this thesis we have presented the synthesis, characterization and physical properties of transition metal dichalcogenide based layered $PbNbS_2$, $PbNbSe_2$ and $SnTaS_2$ systems. Polycrystalline samples of all these compounds were prepared via solid state reaction route following the sealed tube method. This thesis in- troduces two new superconductors $PbNbS_2$ and $PbNbSe_2$, and also discuss theii superconducting properties of polycrystalline $SnTaS_2$. All three systems crystallize in centrosymmetric hexagonal structure with space group P 6 3 /mmc, containing alternative M (= Pb or Sn) and TCh_2 (NbS_2 , $NbSe_2$ or TaS_2) layers in which T atom is accommodated in the trigonal-prismatic co-ordination with Ch atoms while M occupies the octahedral site. The $PbNbS_2$ system is found to be superconducting below T_c □ 8.8 K. Superconductivity in $PbNbSe_2$ is found below T_c □ 5.75 K in association with weak ferromagnetism, which is found to evolve in the close vicinity of the superconducting transition with ordering temperature T_{FM} □ 4.4 K. Coexistence of superconductivity and ferromagnetism in $PbNbSe_2$ is a novel phenomenon by itself and therefore, offers a new platform to investigate exotic physics in this system. Polycrystalline $SnTaS_2$ is found to be superconducting below T_c □ 2.8 K. Detailed superconducting properties and characteristic parameters are discussed by the means of transport, magnetic and thermodynamic studies. The final chapter summarizes all the major results of our investigations on the transition metal dichalcogenide based layered superconducting systems that have been discussed in the preceding chapters and gives the prospect of their future studies and potential applications.
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