Title:	Study of Quasi two Dimensional Electron Gas on Surface Doped SrTiO3(100)
Authors:	Sundar Yadav, Shyam
Keywords:	Electron Gas Electronic Devices
Issue Date:	Nov-2022
Publisher:	IISER Mohali
Abstract:	Abstract Quasi two-dimensional electron systems (q-2DES) are thin conducting or semiconducting materials where electrons are free to move in a two-dimensional plane while restricted in the third direction. Confined motion is governed by the laws of quantum mechanics and can give several interesting physical phenomena. q-2DES not just shows interesting physics but also have a great promise for the development of the future electronic device such as Quantum point contacts, and single electron transistor. Well-known example of the q- 2DES is Metal oxide field effect transistors (MOSFET), semiconductor heterostructures and graphene. Modern-day electronic devices have their own limitation, for example, the dimension of the effective channel length in MOSFET which is made of silicon is reaching the ultimate quantum limit. Ever growing demand of fast information processing and large data storage capability required new material to build the functional devices. Oxides are one of the prominent materials which might play a pivotal role in development of modern electronic devices. Since the discovery of the two dimensional electron gas at the interface of two band insulators, LaAlO3/SrTiO3 (LAO/STO), extensive research have been done to study the SrTiO3(STO) based quasi-two dimensional electron systems. This discovery have laid to several emergent phenomenon such as Rashba spin orbit coupling, two dimensional superconductivity, ferromagnetism and even co-existence of superconducting and magnetic ordering at the same interface. A widely used technique to create the oxide base q-2DES is based on pulsed laser deposition technique and Molecular beam epitaxy. In this thesis work we have developed a technique to electron dope the surface of SrTiO3 using low energy plasma irradiation. Plasma irradiation technique is a very robust and a cost effective technique to engineer the material properties. Using low temperature magneto transport measurements we have shown the observation of the Shubnikov-de Haas oscillation which indicates the high quality nature of the doped surface. The tunability of the doping concentrations allows observing the Kondo like scattering and weak localization effects. Modulation of the electron density using electrostatic gating was used to observe the weak quantum Hall effect. An inverted Lifshitz transition is observed below a critical density. In parallel field configuration, a transvers voltage is observed which can be tuned using the combination of the electric and magnetic field. This transverse voltage can be explained under broken PT symmetry that lead to the observation of the magnetoelectric effect.In the second part of this thesis we have shown the optical properties of the surface doped STO. Tuning the doping conditions allows to the enhancement the conductivity while still maintain the transparent nature of the STO.
URI:	http://hdl.handle.net/123456789/5279
Appears in Collections:	PhD-2014

Files in This Item:

File	Description	Size	Format	
Under Embergo File.odt		11.5 kB	OpenDocument Text	View/Open

Show full item record

Admin Tools

Edit...
Export Item
Export (migrate) Item
Export metadata