Abstract

With the development of nanotechnology within the last few decades, miniaturization of a lot of electromechanical devices has taken place. The nano scale devices have potentials not only to serve for a variety of applications, but can also play an important role in unraveling interesting fundamental physics. Introduction of such devices to ultra low temperatures, where the state of device is not dominated by its thermal energy any more, further increases the expectations to observe interesting quantum phenomenons. In this thesis, we shall focus on nanoelectromechanical resonators at cryogenic temperatures. We have already studied low temperature dissipation in a nano-scale palladium beam of dimensions approximately 5 micron long, 200 nm wide & 80 nm thick and measured resonance frequency of around 34 MHz. To modify the behaviour and further understand physical properties of the two level system with absorbed Hydrogen, a vacuum can is fabricated for the dilution fridge with hermetic DC and radio-frequency feed-throughs to be used at cryogenic temperatures (as low as 10mK). A novel hermetic feed through is developed for high frequency signal communications at cryogenic temperatures with minimal modification to commercially available glass bead equipped SMA. A brief section discussing the theory behind the resonator at low temperature, and in the presence of absorbed hydrogen is also discussed, along with the basic theory of operation of dilution refrigerator.