Everyday, the world uses 320 billion kWh of energy. Energy consumption from fossil fuels has already generated CO$_2$ in 2002 of 2.6 billion tons/year and it is expected to increase in 2030 to 4.2 billion tons/year. According to US DOE Energy Efficiency and Renewable Energy (EERE) over 25% of the heating and cooling energy bills in a typical home are due to bad inefficient windows, door and skylights and namely to the type of glass used. Glass is a crucial element in the home energy efficiency battle. Clear single glass is highly inefficient and causes too much energy to be lost and too much sunlight to enter in homes when unwanted. Insulation of buildings is a key factor in energy efficiency, as the buildings account for a large portion of the total energy consumption in countries like Malaysia, India.

The use of energy efficient windows is steadily increasing in Europe, although many new buildings are still equipped with uncoated standard windows. This is unfortunate since for every standard uncoated window fitted in new production, large amounts of energy will be wasted during the lifetime of this window. This fact is also pointed out in a report from GEPVP recently named as glass for Europe-Europe's manufacturers of building, automotive and transport glass where it is claimed that 1.1 million giga joules of energy would be saved every year if all single and double glazed uncoated windows in Europe were replaced by energy efficient coated windows!

Thin films of group II-VI materials by chemical bath deposition (CBD) is obtained when solution of the material is deposited on substrates. The optical properties of such films are found to be modified when exposed to electromagnetic radiations such as solar radiation. During the exposure, their optical properties assume different values at different wavelengths of the radiation. These properties include absorbance (A), transmittance (T), reflectance (R), absorption coefficient ($\alpha$), extinction coefficient (k), refractive index (n) to mention a few. In essence, the optical properties of thin films are said to be wavelength dependent, varying in values over the spectral regions of electromagnetic spectrum, especially 0.3–3.0 $\mu$m and hence the films are said to be spectrally selective. Such
phenomenon of optical properties varying with wavelengths is known as spectral selectivity and is found to have very interesting and useful applications in solar energy utilization, such as architecture, poultry house, eye glasses industries and electricity generation; others are photovoltaic and photo-thermal in electricity generation. The optical materials known to be produced by such coatings are selective absorbers, heat mirrors, reflective and anti-reflective materials, concentrators, cold mirrors, optical switching etc.

In present thesis, we discuss the preparation of Zinc telluride thin films onto glass substrate and their radiative properties in order to assess the possibility of the use of ZnTe thin films for radiative heating/cooling uses. So, our aim is to investigate the spectral properties, structural properties, morphology and chemical composition of zinc telluride thin films which were deposited using modified CBD or successive ionic layer adsorption and reaction (SILAR) method. The effect of thickness and post-annealing treatment in the modification of spectral properties, structural properties, morphology and chemical composition of chemically deposited thin films will be discussed.

Chapter 1 begins with general introduction of work presented in thesis and its important. A brief overview on group II-VI semiconducting materials and their properties are discussed. As the present work involves the use of group II-VI compounds in thin film form, also an introduction of these compounds in general and zinc telluride in particular is presented in this chapter. Important properties of these materials and general conclusions for their importance in thin film forms are discussed in brief. The chapter ends with the important features of ZnTe thin films.

Chapter 2 includes an over view, applications, thin film growth, deposition techniques and fabrication of ZnTe films using successive ionic layer adsorption and reaction process (SILAR) method. Applications of thin films are discussed in brief. Growing thin films go through several distinct stages, each affecting the resulting film microstructure and hence its physical properties in some, sometimes not reversible, ways; discussed in this chapter. As the growth of these
materials in different forms depends on various growth conditions, it is essential to know about the chemical content of these grown materials, particularly, molar concentration, pH level etc. are a strong function of chemical methods like SILAR. Thus a brief review of different techniques used for deposition of ZnTe thin films are presented here and finally a selection of suitable method for the present work is justified.

In chapter 3, AFM has been used to measure surface morphology. For microanalysis the scanning electron microscope (SEM) has been used. The scanning electron microscope (SEM), which is closely related to the electron probe, is designed primarily for producing electron images, but can also be used for elements mapping, and even point analysis. Scanning electron microscopes which are equipped with EDS (Energy Dispersed Spectroscopy) or EDAX (Energy-Dispersed Analysis of X-rays) detectors that capture the emitted X-rays is used for elemental analysis and conclusions of ZnTe thin films at various thickness and annealing temperature. All these results are presented in this chapter.

It is always important to characterize the grown materials by standard techniques like X-ray diffraction (XRD), Transmission Electron Microscopy (TEM), etc. to evaluate various parameters of the material. In the present study, these techniques have been used to evaluate structural parameters such as preferred orientation, lattice constant, grain size, micro strain, dislocation density, etc.; of ZnTe thin films at various thicknesses and annealing temperatures. The detailed analysis of all these results has been carried out which are systematically given in chapter 4.

Chapter 5 starts with the theoretical back ground of optical absorption in semiconductors. Various optical parameters like the absorption (A), transmission(T), extinction coefficient (K), refractive index (n), optical energy gap (\(E_g\)), etc. were calculated with detailed analysis of UV-VIS-IR spectra for ZnTe thin films at various thicknesses and annealing temperatures. The results are analyzed and discussed in detail in this chapter.
Chapter 6 includes the FTIR characterization of ZnTe in thin film forms. The radiative properties of ZnTe in near and far infrared have been investigated using FTIR spectroscopy, suggesting their possible use as IR transmission windows. The detailed analysis of these results has been carried out in this chapter.

Finally, the general conclusions drawn from the present investigations have been summarized in chapter 7. It is broadly concluded that thin films of ZnTe deposited by SILAR method can be successfully used as IR transmission windows. This chapter also includes discussions about future scope for further investigations, which may be carried out on such characteristics of high transmission in IR which are applicable in photovoltaic industry or solar cell fabrication and also in photo-thermal application.