Alkali halides have always played a leading role in solid state physics. The knowledge of chemical bonding and their simplest structure have made them the suitable systems for verifying theories. They are also the first materials of choice in many pioneering experiments. Alkali halides are the convenient systems for scaling of properties.

An attempt has been made to check the suitability of grown crystals for information storage in the visible as well as X-ray regions, tuneable lasers also as a pressure marker. Doped alkali halides find application as thermoluminescence dosimeter device materials.

Pure alkali halides are less stable and have poor mechanical strength. These limitations can be overcome by mixing and adding impurities in them. Hence it has been found to be useful and necessary to grow and characterize ternary crystals of various compositions.

The doping of alkali halide crystals into certain non-linear materials is found to enhance the second harmonic generation efficiency as well as their mechanical strength.

The ternary crystals were subjected to many characterizations, to understand their potential applications.

Ammonium dihydrogen orthophosphate (ADP), an NLO material, has gained some importance in recent past. Organic non linear optical
(NLO) materials show very good second harmonic generation efficiency (SHG) than inorganic NLO materials.

This thesis is divided into seven chapters:

In **chapter one**, a general introduction to single crystals of the alkali halides is given. The characteristics of single crystal alkali halides, the need of binary and ternary alkali halide single crystals, effect of doping rare earth elements into single crystal alkali halides for thermoluminescent dosimetric applications and optical information storage devices, the role of mixed alkali halides in optical and electronic devices, as transducers, effect of doping alkali halides and other inorganic materials into inorganic as well as organic non-linear optical crystals, their potential uses in industry and their significance in the field of research are discussed.

The **second chapter** deals with relevant theory used for the characterization of single crystals and the various instruments used for the measurement. During the present investigation, various tools and techniques used for characterization of grown crystals, namely X-ray diffraction (XRD), UV-Visible transmission, energy dispersive X-ray analysis, dielectric studies, A.C. conductivity studies, microhardness studies, second harmonic generation (SHG) efficiency test, the details of Co-60 gamma irradiation chamber is outlined in this chapter.

The **third chapter** is about crystal growth. In the last few decades the growth of single crystals has assumed enormous importance
because of their research and industrial use. Defect free single crystals are the backbone for solid state electronic device making.

Single crystals can be grown by many methods ranging from easy to complex methods. Some techniques are inexpensive and some are expensive process. The duration of growth process may be ranging from few minutes to few years.

Among all the methods of crystal growth, solution growth is most simple and versatile. Best quality crystals can be grown from this method for various applications. This is the method adopted in the present work for growing crystals.

The **fourth chapter** deals with structural, electrical and optical properties. For convenience the chapter is divided into two sections. The first section deals with details of the following study:

a) Dielectric properties of ternary alkali halide single crystals like variation of dielectric parameters and A.C. conductivity as a function of frequency. Checking the suitability of single crystals of different compositions for a good candidature for capacitors from their impedance plots (Nyquist plots).

b) Optical absorption spectra to know the transparency of the crystals and FTIR studies to find out the functional groups.

c) Structural properties include XRD to find the lattice constants, comparing empirical values with the theoretical values which
are calculated from generalized Vegard’s law for ternary crystals. Energy dispersive X-ray (EDAX) spectroscopy to check the presence of all the host elements and doped one in the single crystals. Scanning electron microscope (SEM) images to know the surface morphology.

The second section of this chapter deals with dielectric properties of ammonium dihydrogen phosphate (ADP) and amino acids doped with inorganic compounds.

The fifth chapter deals with Mechanical properties. This chapter also contains two sections.

The first section deals with single crystals of ternary alkali halides. Discussion of microhardness (to know the mechanical strength), Mayer’s work hardening coefficient (to know whether the crystals belong to hard or soft category), elastic stiffness constants (to know the bonding strength between neighboring atoms), standard hardness parameter etc. is given.

The second section of this chapter deals with microhardness properties of doped single crystals of NLO materials. Doping of inorganic materials into organic NLO materials has been done to increase the mechanical strength of the crystals.

The sixth chapter deals with effect of irradiation and rare earth doping on thermoluminescence properties of ternary alkali halides.
Alkali halide crystals doped with different rare earth elements are found to be very efficient thermoluminescence (TL) dosimeters.

The summary and scope of future work is given in the seventh chapter

Some of the results presented in the thesis have been published and communicated in the form of research articles.