viscoelastic properties play a dominant role.

A comparative analysis of the damage threshold measurements carried out in transparent-conductive coatings has established that spray pyrolysis deposited tin oxide films are also equally good competitors with rf sputtered indium tin oxide films and chemical vapour deposited tin oxide films in high power laser systems as electrodes for electro-optic shutters. Spray pyrolysis technique offers the added advantage of greater flexibility in terms of their electrical and optical characteristics depending on the deposition parameters which in turn depends on damage threshold.

A noteworthy feature of this thesis is the identification of polyacrylonitrile (PAN) films of high damage threshold (26 J/cm²) with very low-level absorption at 1060 nm. Another interesting feature associated with these films is that the damage threshold of these films increases with increase in thickness unlike in the case of dielectrics. This makes these films very good candidates for high energy laser applications.

Various types of attempts are being made to increase the threshold of AR coatings since they are the weakest link in any high power laser system. In the present investigation the threshold of a half-wave layer of Mg F₂ films has been shown to increase by about 50% when PAN film having a high threshold was given as an undercoat. The result obtained has been attributed to the change in the chemical environment and to better adhesion of the Mg F₂ films on PAN. In the case of investigation on Mg F₂ films, the threshold is shown to decrease with increase in film thickness as reported by earlier workers. Low damage threshold obtained in the case of gold films has been explained in terms of the low yield stress of the material and its high absorptance at 1060 nm. Gold coating with an undercoat of PAN does not show any variation in the damage threshold value which is attributed to the poor adhesion of gold on PAN.

Another important result that has emerged out of the present investigations is the determination of the concentration limit of two-photon excited fluorescence in rhodamine 6G.


The thesis presents a study of the growth of Diammonium Hydrogen Citrate (DAHC) and Citric acid (CA) monohydrate single crystals from solution and their defect structures. The result of the microindentation and thermal analysis are presented. Dielectric, fractographic, IR and UV studies of DAHC crystals are also reported.

Large and perfect crystals of size up to (60X27X5) mm³ were grown by slow evaporation in a constant temperature bath. The faces of the grown crystals were identified by angular measurements using goniometer.

Dislocation etch studies have been carried out to assess the perfection of DAHC and CA crystals. Dislocations in DAHC crystals were delineated by propanolic acid which was found to be a reliable dislocation etchant for the (001) face. Dislocation loops, helices, clusters, impurity centers and slip lines are observed with this etchant. The etch pit density is found to be of the order of 1-2X10⁷/cm². Other etchants like formic acid, acetic acid and methyl alcohol were also found to be capable of bringing out dislocations on the (001) face. The shape of the pit is etchant used. The etch pit formation in DAHC of the thermodynamic theories of etching is found to be a good dislocation etchant. Microindentation analysis of DAHC and pyramidal indenter to study the hardness of cracks. The hardness of DAHC was found to be of cracks, up to a load of 12.5 gms. The fracture toughness was found to increase with increase in thickness unlike in the case of dielectrics. This makes these films very good candidates for high energy laser applications.

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Another important result that has emerged out of the present investigations is the determination of the concentration limit of two-photon excited fluorescence in rhodamine 6G.


In 1931 Dirac studied the motion of an electric monopole and found that the quantization by postulating the mere existence of a magnetic monopole has been a resurgence of interest in magnets. 't Hooft and Polyakov independently of finite energy topologically stable solutions to these theories. The thesis, "Studies on Magnetic Gauge Theories and Related Problems", presents classical solutions of non-abelian gauge magnetic monopoles and dyons which are charge carriers. The formation of bound states of
growth of Diammonium Hydrogen Citrate (DAHC) film having a high threshold was investigated. The identification of polyacrylonitrile (PAN) position parameters which in turn depend on the bath. The faces of the grown crystals are observed at 1060 nm. Gold antireflection coatings were deposited on these films. The damage with load was analysed up to a load of 12.5 gms. The fracture toughness of DAHC is 0.17 MPa \( \sqrt{m} \). Loads up to 25 gms were used for the toughness evaluation. The toughness value is found to increase with increase in load in a regular manner. Brittleness of DAHC is found to be 4.04 m on the (001) face. The shape of the pit is found to depend on the type of the etchant used. The pit growth in DAHC crystals is explained on the basis of the thermodynamic theories of etching. For CA crystals, also propionic acid is found to be a good dislocation etchant.

Microindentation analysis of DAHC and CA crystals was done using Vickers pyramidal indenter to study the hardness, toughness, brittleness and the nature of cracks. The hardness of DAHC was found to be 0.68 GPa. The hardness of DAHC was found to be nature of cracks. The hardness with load was analysed up to a load of 12.5 gms. The fracture toughness of DAHC is 0.17 MPa \( \sqrt{m} \). Loads up to 25 gms were used for the toughness evaluation. The toughness value is found to increase with increase in load in a regular manner. Brittleness of DAHC is found to be 4.04 m. Surface removal technique has shown that the threshold crack is radial and originate from the surface. From the indentation studies, hardness of CA was found to be 0.588 GPa. The Variation of hardness with load is found to have a minimum around 7.5 gms. The toughness is 0.132 MPa \( \sqrt{m} \) and the brittleness is 4.48 m. The (110) cleavage surface of DAHC exhibit typical examples of hackle structure. Wallner lines and many other interesting crystallographic markings. They are presented and discussed.

Dielectric studies were made on DAHC crystal along the three mutually perpendicular crystal axes in the region of temperature 133 K and frequency 200 to 20,000 Hz. The dielectric permittivity and the loss tangent measurements were made in a low temperature dielectric cell with heating arrangement. The IR spectrum of DAHC was recorded in the region 4000 - 200 cm\(^{-1}\). Absorption bands are observed at frequencies 3400, 3200, 3060, 2860, 1690, 1400, 1320, 1270, 1230 and 1090 cm\(^{-1}\). These bands are tentatively assigned to the (001) face. The shape of the pit is found to depend on the type of the etchant used. The pit growth in DAHC crystals is explained on the basis of the thermodynamic theories of etching. For CA crystals, also propionic acid is found to be a good dislocation etchant.