

CONTENTS

CHAPTER-I : THIN FILM.

- 1.1 PVD Techniques.
 - 1.1.1 Thermal Evaporation.
- 1.2 Mechanical properties of thin films.
 - 1.2.1 Adhesion.
 - 1.2.1.1 Methods to determine adhesion.
 - 1.2.1.1.1 Scotch tape method.
 - 1.2.1.1.2 Scratch method.
 - 1.2.1.1.3 Abrasion method.
 - 1.2.1.1.4 Direct pull off method.
 - 1.2.1.1.5 Moment or topple method.
 - 1.2.1.1.6 Ultra centrifugal and ultrasonic methods.
 - 1.2.2 Stress.
 - 1.2.2.1 Stress measuring techniques.
 - 1.2.2.2 Disk method.
 - 1.2.2.3 Bending beam methods.
 - 1.2.3 Tensile strength.
 - 1.2.4 Hardness.
 - 1.3 Optical properties of thin films.
 - 1.3.1 Introduction.
 - 1.3.2 Thin film optics.
 - 1.3.3 Theory of reflection and transmission.
 - 1.3.4 Optical coatings development and types.
 - 1.3.4.1 Various types of optical coatings.
 - 1.3.4.1(a) Antireflection coatings.
 - 1.3.4.1(b) High reflecting systems.

- 1.3.4.1(c) Interference filters.
- 1.3.4.1(d) Thin film polarizers.
- 1.3.4.1(e) Other optical coatings.
- 1.3.5 Materials used in optical coatings with special reference to dielectric oxide films.
- 1.3.5(1) Characteristics of some oxide materials used in optical coatings.
- 1.3.6 Limitations of optical films.
- 1.3.7 Aging of optical films.
- 1.3.7.1 Aging scale.
- 1.3.7.2 Packing density.
- 1.3.7.3 Effect of moisture
- 1.3.7.4 Temperature effect.
- 1.3.7.5 Stresses in the layers.
- 1.3.7.6 Other factors.
- 1.4 Review of studies on cerium oxide films.
- 1.5 Techniques for measuring various optical constants of dielectric films.
- 1.5.1 Abele's technique.
- 1.5.2 Spectrophotometry.
- 1.5.3 Ellipsometry.
- 1.5.4 Wave guide method.
- 1.5.5 Envelope method.
- 1.5.6 Polarimetry.
- 1.6 Theory of ellipsometer
- 1.6.1 (Δ) and (Ψ) measurement theory.
- 1.6.2 Review of some of the recent studies on ellipsometric technique.
- 1.7 Aim and scope of this work.

CHAPTER-II : DEPOSITION OF CeO₂ FILMS AND
PROPERTY STUDIES.

- 2.1 Experimental methods.
- 2.2 Vacuum system used for deposition.
- 2.3 Substrate used and its cleaning.
- 2.4 Method of film preparation.
 - 2.4.1 Single film by chopping.
- 2.5 Systems for the aging studies.
 - 2.5.1 System for study under moisture at room temperature conditions.
 - 2.5.2 Room temperature moisture ~3'hour's - air.
 - 2.5.3 System for study under cold moisture.
 - 2.5.4 System for study under salty moisture at room temperature.
 - 2.5.5 System for study on heating.
- 2.6 Thickness measurement.
- 2.7 Adhesion measurement.
- 2.8 Stress measurement.
- 2.9 Description of ellipsometer used.
 - 2.9.1 Experimental procedure followed.

CHAPTER-III : RESULTS,

- 3.1 Introduction.
- 3.2 General plan in the present work.
- 3.3 Data of adhesion and ellipsometric measurement of fresh films.
 - 3.3.1 Scatter diagram.
 - 3.3.2 Average data for fresh films.
 - 3.3.3 Aging under different ambients.
 - 3.3.3.1 Aging in air.

- 3.3.3.2 Effect of moisture on adhesion and Δ, Ψ .
- 3.3.3.2(a) Aging in room temperature moisture.
- 3.3.3.2(b) Effect of cold moisture (8 c)^o
- 3.3.3.2(c) Effect of salty moisture at room temperature.
- 3.3.3.3 Effect of heat (120 c)^o
- 3.3.3.4 Average values of available data.
- 3.3.3.5 Summary of some important results.

CHAPTER-IV : DISCUSSION.

- 4.1 Introduction.
- 4.2 Adhesion and stress of cerium oxide films and effect of chopping.
 - 4.2.1 Effect of various ambients on adhesion.
- 4.3 Discussion on ellipsometric parameters.
 - 4.3.1 Discussion on fresh films.
 - 4.3.2 Effect of ambients on (Δ), (Ψ) [refractive index.]
- 4.4 Conclusion.
- 4.5 Scope of future work.