

**SELECTIVE COATINGS AND HEAT LOSS
MINIMIZATION IN FLAT PLATE COLLECTORS
OPERATING UNDER CONCENTRATED SOLAR FLUX**

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ABSTRACT

The work reported in this thesis is devoted to the investigations on various components of a solar thermal system capable of providing work fluid temperatures in the range 100-200°C. The experimental measurements and/or theoretical analyses, as carried out by the author, aim at the specific purpose to work out inexpensive but effective materials and growth processes for selective absorber coatings and to work out the geometrical design parameters and operational configuration of the collector to achieve minimum heat losses from the absorber collector assembly. The investigations also aim at working out a concentrator design and configuration which could effectively concentrate the solar flux on the absorber while requiring minimal tracking. The investigations are further extended to study the performance of a solar thermal system which incorporates the optimized designs and operational configurations of the absorber collector and the concentrator. The experimental and the theoretical investigations carried out by the author in this direction are presented in seven chapters in the thesis.

Chapter I considers the basic requirements of a medium temperature (100-200°C) solar thermal system for efficient operation and includes a brief review of the available literature related to the materials, components and subsystems of such solar thermal systems.

Chapter II includes the experimental set ups used by the author for the growth of selective absorber coatings and for the

measurements of photothermal, thermal, structural and optical characteristics of the films. Experimental set ups used for comparative solar thermal performance of the flat plate collectors to work out the optimized collector geometry and operational configurations are also included.

Chapter III is devoted to the study of growth of solar selective coatings of black nickel, NiS-Pbs and NiS-CdS mixed films. Chapter IV is devoted to the experimental and theoretical investigations to optimize the collector geometry and operational configurations for stagnant and fluid flow conditions. Chapter V is devoted to the performance analysis of a Fresnel reflecting concentrator for its various possible settings and operational configurations. Performance in field conditions of a test system incorporating the optimized collectors of chapter IV and the experimental concentrator of Chapter V is reported in Chapter VI. Some possible directions in which the work done by the author could be extended are proposed in Chapter VII.

CONTENTS

| | Folio |
|---|-------|
| ABSTRACT | (i) |
| CHAPTER I INTRODUCTION | 1 |
| 1.1 Selective Absorber Surfaces | 4 |
| 1.1.1 Absorptance, Emittance and Figure of Merit | 5 |
| 1.1.2 Need for Spectral Selecti- vity. | 7 |
| 1.1.3 Desirable Characteristics of a Selective Absorber Surface | 8 |
| 1.1.4 Methods of Obtaining Selectivity | 8 |
| 1.2 Reduction of Heat Losses in Solar Collectors | 19 |
| 1.2.1 Solar Collector Types | 19 |
| 1.2.2 Efficiency of a Solar Collector | 21 |
| 1.2.3 Heat Loss in Solar Collectors | 21 |
| 1.2.4 Reduction of Radiative Losses | 25 |
| 1.2.5 Reduction of Convective and Conductive Losses | 25 |
| 1.3 Solar Concentrators | 29 |
| 1.3.1 Concentrator Parameters | 30 |
| 1.3.2 Concentrator Classifi- cation | 30 |
| 1.3.3 Linear Solar Concentrators | 31 |
| 1.4 The Present Work | 38 |

| | Folio |
|---|-------|
| CHAPTER II EXPERIMENTAL SET-UP AND MEASUREMENT TECHNIQUES | 43 |
| 2.1 Introduction | 43 |
| 2.2 Spray Pyrolytic Growth of Selective Absorber Coatings | 43 |
| 2.2.1 Experimental Set-Up | 43 |
| 2.2.2 Growth Parameters | 44 |
| 2.2.3 Cleaning of the Substrates | 45 |
| 2.2.4 Deposition of the Films | 45 |
| 2.3 Measurement of Thickness of the Films | 46 |
| 2.4 Measurements for Photothermal Performance of Films | 47 |
| 2.5 Measurements for Structural Behaviour of Films | 49 |
| 2.5.1 Transmission Electron Microscopy | 49 |
| 2.5.2 Scanning Electron Microscopy | 50 |
| 2.6 Measurements for Optical Behaviour of Films | 50 |
| 2.6.1 Absorptance Measurements | 50 |
| 2.6.2 Emittance Measurements | 52 |
| 2.6.3 Angular Reflectance Measurements | 54 |
| 2.7 Thermal Stability Testing of Films | 55 |
| 2.8 Mechanical Stability Test | 56 |
| 2.9 Experimental Set-up for optimization of Collector Parameters in the Flat Plate Configurations | 57 |

| | | |
|-------------|--|----|
| CHAPTER III | SPRAY PYROLIZED BLACK NICKEL, NiS-PbS AND NiS-CdS SELECTIVE ABSORBERS | 59 |
| 3.1 | Introduction | 59 |
| 3.2 | Black Nickel | 60 |
| 3.2.1 | Preparation of the Films | 61 |
| 3.2.2 | Optimization of Growth Parameters | 64 |
| 3.2.3 | Structure of the Films | 66 |
| 3.2.4 | Optical Properties of the Films | 70 |
| 3.2.5 | Mechanical and Thermal Stability of Films | 72 |
| 3.3 | Nickel Sulphide-Lead Sulphide and Nickel Sulphide - Cadmium Sulphide Coating | 74 |
| 3.3.1 | Nickel Sulphide-Lead Sulphide | 74 |
| 3.3.1a | Preparation of the Films | 74 |
| 3.3.1b | Photothermal Studies of the Films | 75 |
| 3.3.1c | Structure of the Films | 76 |
| 3.3.1d | Optical Properties | 77 |
| 3.3.1e | Mechanical and Thermal Stability | 81 |
| 3.3.2 | Nickel Sulphide - Cadmium Sulphide | 82 |
| 3.3.2a | Preparation of the Films | 82 |
| 3.3.2b | Photothermal Studies of the Films | 83 |
| 3.3.2c | Structure of the Films | 83 |
| 3.3.2d | Optical Properties | 84 |
| 3.3.2e | Mechanical and Thermal Stability | 87 |

| | Folio |
|--|-------|
| CHAPTER IV | |
| MINIMIZATION OF HEAT LOSSES IN FLAT PLATE COLLECTOR CONFIGURATION | 88 |
| 4.1 Introduction | 88 |
| 4.2 Heat Loss Reduction in Flat Plate Collectors | 90 |
| 4.2.1 Collector Back-face Insulation | 90 |
| 4.2.2 Absorber to Cover Glass Separation | 93 |
| 4.3 Evaluation of Heat Loss Coefficients in Flat Plate Collectors in Hori- zontal Configuration | 101 |
| 4.3.1 Back Loss Coefficient Evaluation | 102 |
| 4.3.2 Top Loss Coefficient Evaluation | 104 |
| 4.4 Stagnation Temperature as a Function of Heat Loss Coefficients | 109 |
| 4.4.1 Theoretical Analysis | 109 |
| 4.5 Low Loss Design of Flat Plate Collectors in the Normal and the Reverse Configurations | 114 |
| 4.6 Heat Transfer Evaluation from Rectangular Duct Absorbers in Flat Plate Collectors | 115 |
| 4.6.1 Theoretical Analysis : Rectangular Duct in the Normal and Reverse Flat Plate Configurations | 116 |
| 4.6.2 Stagnation Efficiency for Recangular Duct in the Normal and the Reverse Configuration | 120 |
| NOMENCLATURE | 124 |
| APPENDIX 'A' | 129 |
| APPENDIX 'B' | 130 |

| | Folio |
|---|-------|
| CHAPTER V | |
| LINEAR FRESNEL REFLECTING CONCENTRATORS FOR REVERSE FLAT PLATE DUCT COLLECTORS | 131 |
| 5.1 Introduction | 131 |
| 5.2 Operational Configuration of the Fresnel Concentrator for East-West Orientation | 133 |
| 5.3 Geometrical Design Analysis | 134 |
| 5.3.1 Horizontal Concentrator Frame Set for Zero Senith Angle | 135 |
| 5.3.2 Finite Zenith Angle; Concen- trator Frame Tilted from Horizontal | 140 |
| 5.3.3 Horizontal Concentrator Frame Set for Equinox Incidence | 149 |
| 5.3.4 Concentrator Frame Set to Equinox Incidence; Tilted from Horizontal | 153 |
| 5.4 Experimental Study of a Fresnel Reflecting Concentrator | 163 |
| 5.4.1 The Experimental Concentrator | 163 |
| 5.4.2 Performance of the Concen- trator | 165 |
| 5.4.2a Effect of Receiver Height | 165 |
| 5.4.2b Effect of Number of Mirror Elements | 166 |
| 5.4.2c Image Shift due to the Daily North-South Swing of the Sun | 168 |
| 5.4.2d Separation for the Practical Design | 170 |
| NOMENCLATURE | 172 |

| | Folio |
|--|-------|
| CHAPTER VI STUDY OF 'REVERSE FLAT PLATE COLLECTOR - FRESNEL REFLECTING CONCENTRATOR' SYSTEM | 174 |
| 6.1 Introduction | 174 |
| 6.2 Experimental Concentrator-Absorber | 175 |
| 6.2.1 System | 175 |
| 6.2.2 Measurements | 176 |
| 6.2.3 Efficiency | 176 |
| 6.3 Performance Analysis of the Concentrator-Absorber Collector | 178 |
| CHAPTER VII CONCLUSIONS AND FUTURE SCOPE OF WORK | 180 |
| 7.1 Conclusions | 180 |
| 7.2 Future Scope | 182 |
| REFERENCES | 183 |
| BIO-DATA | 195 |