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Spectral Properties of Ash for use as a Solar Selective Coating

J. Packiam Julius, T.K. Jayaleka
Department of Physics, Pioneer Kumaraswamy College, Nagercoil, Tamilnadu, India
Corresponding Author: dr.j.pjulius@gmail.com

Abstract

New attempts have been made to study the spectral properties of ash for use as a solar selective coating. Ash coating has been added as a better efficient coating to the other commercially available coatings. Investigations have been made to study the reflectance properties of ash coating. The reflectance of the ash coating was compared with that of other two coatings namely black chrome and black nickel. Ordinary painting method has been adopted as the coating technique. Aluminium absorber has been used which was coated with colloidal ash and was allowed to dry. Water heating test has been carried out to study the optical efficiency of ash on Aluminium vessel. For solar thermal applications, this coating has been proved to be one of the best solar selective coating with maximum optical efficiency.

Key Words: Reflectance, optical analysis, emissivity

1. Introduction

To get maximum efficiency and maximum temperature in spiral concentrator the absorber material should have a maximum absorbtance across the solar spectrum and minimum emissivity in the IR region. It should also be cheap and easy to prepare. The reflectance values got are shown and compared with other two coatings, namely black chrome and black nickel.

2. Experimental

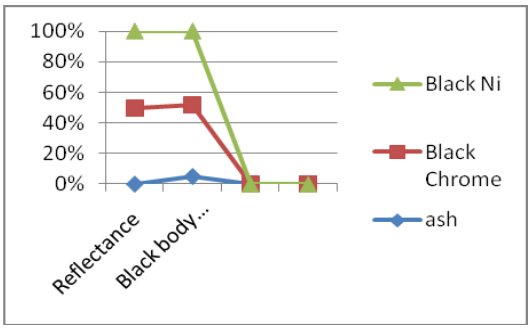
The method of getting the solar selective coating to coat with metallic plate (Aluminium) with a colloid solution of ash and it was allowed to dry in shade for 2 or 3 days. After that, studies are done and compared with that of black chrome and black nickel.

3. Results

The reflectance properties got are shown in table 1.

Table 1. Comparison of reflectance of various coatings

	Ash	Black Chrome	Black Ni
Reflectance	0.130	0.132	0.133
Black body spectrum at 250°C	0.095	0.912	0.934



The optical analysis of the solar absorber could be done from these data in addition to transmittance and ellipsometry data by fither the data to other coatings [2,4,5] the optical constants of ash layer is some what lower than that of other coatings. The exinction coefficient is higher in the first layer of the coating Both effective refractive index and exinction coefficient of the ash layer increases with increasing wavelength as for metallic index [3,6,7,8]. The optical performance of the ash coating is 0.9/0.078 on Aluminium substrate.

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Table 2 Optical efficiency of ash coating

Date : 06-05-17
Starting time : 12.14 pm
Amount of water : 0.964kg
Ambient temp : 29.5°C
Absorber : Aluminium

Temp Region °C	Mean temp above ambient °C	Energy lost Watts	Energy used Watts	Input Watts	Optical efficiency %
29-41.5	3.25	6.638	436.0	524.5	84.3
54.5-53.4	15.45	31.568	415.113	524.61	85
53.4-64.26	26.82	54.72	378.485	524.75	82.35
64.25-74.25	37.25	76.101	348.835	524.76	80.97
74.25-90.2	50.25	102.62	277.67	524.8	72.48

The optical efficiency hikes to a maximum value when ash is used as the solar selective coating for Aluminium absorber.

Optical efficiency depends on many factors such as insolation, optimum temperature, ambient temperature, wind velocity, percentage of humuidity in air etc, the absorber coating show a considerable increase in its value because of the nature of the material used namely ash. If a pressure cooker is used in the place of ordinary Aluminium pot, we expect the efficiency to increase more.

4. Conclusion

The spectral studies and optical analysis of Aluminium absorber coated with a solar selective ash coating has selective properties. This surface has been critical to high temperature solar thermal operations.

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