

Accepted Manuscript

Temperature and Heat Flux at Residential Surfaces due to Solar-Beam Radiative Selectivity, Geography/climate, Insulation/structural Configuration, Humidity, and Sky Condition

P.H. Coons, E.M. Sparrow, J.M. Gorman

PII: S2451-9049(17)30007-0

DOI: <http://dx.doi.org/10.1016/j.tsep.2017.07.001>

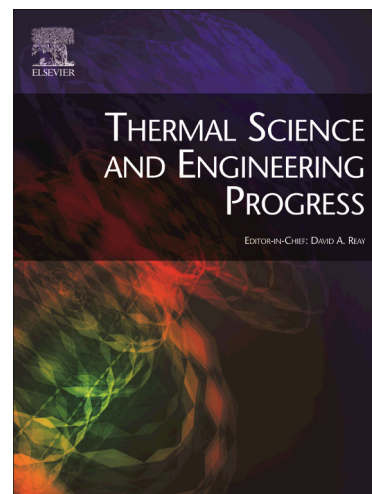
Reference: TSEP 42

To appear in: *Thermal Science and Engineering Progress*

Received Date: 9 January 2017

Revised Date: 1 July 2017

Accepted Date: 1 July 2017



Please cite this article as: P.H. Coons, E.M. Sparrow, J.M. Gorman, Temperature and Heat Flux at Residential Surfaces due to Solar-Beam Radiative Selectivity, Geography/climate, Insulation/structural Configuration, Humidity, and Sky Condition, *Thermal Science and Engineering Progress* (2017), doi: <http://dx.doi.org/10.1016/j.tsep.2017.07.001>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Temperature and Heat Flux at Residential Surfaces due to Solar-Beam Radiative Selectivity, Geography/climate, Insulation/structural Configuration, Humidity, and Sky Condition

P.H. Coons, E.M. Sparrow, J.M. Gorman *

Department of Mechanical Engineering, University of Minnesota, 111 Church Street SE, Minneapolis, MN 55455, USA.

Abstract

Extensive recent published literature has shown that the use of selectively highly reflecting coatings for solar beam radiation incident on roof surfaces during the summer has increased the solar albedo and decreased the need for electricity consumption to maintain building temperatures. In this paper, other issues relevant to the temperatures, heat fluxes, and human comfort related to solar energy are addressed. In particular, numerical simulation is used to focus on limited locations in the United States (Phoenix, AZ, Miami, FL, and Minneapolis, MN) for mid-summer and mid-winter climatic conditions. At these locations, two different insulation systems relevant to residential housing in the United States are considered. Not only is solar beam radiation taken into account, but also is infrared sky radiation, humidity of the surrounding air, cloud cover, air temperature, and the emissivity of water vapor droplets. The results presented include: (a) diurnal temperature and heat flux variations at the exterior surfaces, (b) temperatures and heat fluxes at internal surfaces, (c) heat flowing from the internal surfaces, (d) an accounting of the heat transferred respectively by conduction, convection, and radiation at the exterior surface, (e) convective heat transfer coefficients at the exterior surface. The results are presented over a 24-hour period on both June 21 and December 21. Equal focus was given to summer-season and winter-season performance of the radiatively selective coating. It was found that although the coating was highly advantageous for summer conditions, it significantly increased the power requirements for winter heating.

Keywords: Wavelength-selective paints, Building heat transfer, Passive cooling, Solar radiation

* Corresponding author.

E-mail address: gorma157@umn.edu (J.M. Gorman).

Download English Version:

<https://daneshyari.com/en/article/8918880>

Download Persian Version:

<https://daneshyari.com/article/8918880>

[Daneshyari.com](https://daneshyari.com)