UNIVERSITI TEKNOLOGI MARA

TECHNICAL REPORT

A STUDY OF HEAT TRANSFER IN DOUBLE AND TRIPLE WINDOW PANE: A CASE STUDY IN TURKEY

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IN THE NAME OF ALLAH, THE MOST GRACIOUS, THE MOST MERCIFUL

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ABSTRACT

In this study,the heat transfer through double and triple pane windows are numerically analyzed by using Fourier's Law of heat conduction. The aim of this study are to find heat transfer in double and triple windows by using different types of materials and different gap lengths between the windows in different outdoor temperature and to find the best types of materials used for windows and suitable gap lengths between the windows in different outdoor temperature. The temperature data comes from Ankara and Kars cities of Turkey. The result show that heat losses through the windows can be reduced by increasing the gap width between the windows by using polycarbonate sheet instead of glass.

1 INTRODUCTION

1.1 Research Backgroud

Heat is known as thermal energy. Thermal energy is an example of kinetic energy as it is resulted from the motion of object particles. Temperature is used to measure these vibrations in degree Celsius (°C) or Kelvin (K). Heat transfers from high temperature region to the lower temperature region. It can be classified into three types which is heat conduction, heat convection and radiation.

Heat conduction is the heat energy transferred from a high temperature region to the low temperature region through diffusion. Fourier's Law is used to calculate heat conduction. Heat convection is heat transfer through the movement of fluid particles. It occurs in liquids and gases only. Newton's law of cooling states that the rate of change in the temperature of an object is directly proportional to the difference temperature of the surrounding. This law describes and suits the condition of heat convection. Radiation is a method of heat transfer in the form of electromagnetic waves which travels through matter or empty space.

According to Aydin (2000) many countries are taking improvement in energy efficiency in building due to the increase of cost. The study focus on consumption of low energy in building by using pane windows because most of the air conditioner and heat energy will loss through windows. Windows are very important component in building, however it has been said that windows are like thermal holes of heat loss and poor insulation characteristics that can lead to energy losses in the building. This paper focuses on heat transfer through windows in the city of Antalyana and Kars of Turkey. According to Arici et al. (2015), Turkey used about 31% of total energy in building and about 30% of the energy lost through windows in a typical building and the rest lost through wall,roof,door or floor. Energy loss from a building occurs 40% through external walls, 30% through windows, 17% through doors, 7% through roof, and 6% from floors Arici & Karabay (2010)