UNIVERSITI TEKNOLOGI MARA

NEW CARBON-BASED INDIGENOUS HOLLOW MICROWAVE ABSORBER

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ABSTRACT

Electromagnetic absorber has been improved from time to time and it is highly demanding for microwave absorption. However, wideband communication systems which operate at microwave frequencies required appropriate electromagnetic interference shielding to preserve signal integrity. This thesis presents a novel carbon-based indigenous hollow microwave absorber design and development with the frequency bandwidth within the 8 to 12 GHz. The main objective is to design and develop an indigenous microwave absorber with an acceptable absorption performance characteristic which is has been successfully implemented. In order to develop this absorber, the mentioned unique design and development of an indigenous microwave absorber were applied. This project examines a selected carbon-based indigenous material that is capable to absorb electromagnetic wave to investigate the effect of shape towards microwave absorption performance of the absorber. The absorber is fabricated using cardboard and indigenous carbon coated as the absorbing materials. Simulation results for the carbon-based indigenous hollow microwave absorbers shape are obtained using frequency domain in CST Microwave Studio software. The free space arch reflectivity measurement method is used to measure the hollow pyramidal microwave absorber performance. Experimental results show that the designed absorbers exhibit good absorption characteristics over a wide range of frequency. By using a new design of slotted technique was improved the performance of absorption. Result shows, a hollow indigenous microwave absorber performs a good renewal in the design of the microwave absorber. The absorbers design was measured the polarization independence absorption for both TE and TM. The results show that both polarization gives a good overview of absorption at each measurement frequency along with the simulation result. The best indigenous performance of microwave absorber can absorb more than -20 dB on the overall range of 8 to 12 GHz shows comparative to commercial. The use of cardboard as the desired form is accelerating for the construction of indigenous microwave absorber besides cost effective preparation of the measurement method according to the allowed standard has resulted in the correct and good results and can also provide the best possible absorber construction. Therefore, this project has achieved its goal.

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"Fear Allah, Allah will teach you and Allah is All-Knowing of all things."
"A clever person is the one who calculates himself and works for the preparation after death, the weak one is the one who follows his own desires and always lies to Allah"

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CHAPTER ONE
INTRODUCTION

1.1 Introduction

Microwave absorber is widely used as a defence or as a weakening disturbance electromagnetic wave interference. Microwave absorber has been used in various applications to eliminate stray radiation that could interfere the operation of the system. Absorber can be used to reduce reflection or external transfers to a particular object and also can be used to reduce the flood of changes caused by resonant cavity. There are two fundamental concepts used in the design of radiation absorbent material usually name as RAM[1]. First is the concept of matched characteristic impedance where the planned absorber is invariably thick in terms of electrical wavelength and the second is the concept of a matching wave impedance often used in resonant absorber design. Absorber can also be used for the realization of free space neighbourhood with eliminating reflections in anechoic chamber. The first patented absorbent materials are useful in resonant material placed in 2 GHz region. Electromagnetic wave absorber from the first commercial has been used to increase the ratio of front to back antenna [2]. Techniques of electromagnetic absorption used in the first trial was to modify the surface characteristics of the target so that it will reduce the effective reflected area came from electromagnetic waves. However, this kind of technique depends on the frequency and with the development of microwave technology, the radar performances increased which enabling it to send signal of higher frequencies and wider bandwidth, later became necessary for hiding the target with various sophisticated approaches.

Figure 1.1 shows the spectrum of electromagnetic waves according to wavelength (in meter), size of wavelength, common name of wave, sources and frequency used. As a result, initial absorption technique that uses a target structure surreptitious customization is no longer effective for broadband applications. The most practical approach is to combine the materials of a microwave with a signature of broadband absorption width and made the target practical towards these materials. A thorough investigation of the effort has been directed to review material properties and developed microwave absorbent to suit various applications.