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ANTI MICROWAVE RADIATION BAMBOO ROOFING

Norhayati Mohamad Noor*, Linda Mohd Kasim, Nazirah Mohamat Kasim, Hasnain Abdullah@Idris, Muhammad Fazrul Afiq Ali Mokhtar, Azizah Ahmad and Noor Azila Ismail

*Faculty of Electrical Engineering, Universiti Teknologi MARA (UiTM),
Cawangan Pulau Pinang, MALAYSIA*

**E-mail: hayati005@uitm.edu.my*

ABSTRACT

Bamboo is a natural source that is abundantly available for housing roofing materials. It is a great significance to develop the roofing material with absorbing function for electromagnetic radiation shielding. This study is conducted to design a corrugated arrangement bamboo roofing microwave absorber that can absorb electromagnetic wave for frequencies 1 to 12 GHz. Three models of bamboo roofing with different corrugated arrangement namely Model A, Model B and Model C has been developed. The size of all types of proposed bamboo roofing is 60 cm width x 60 cm in length. The design is simulated using Computer Simulation Technology (CST) Microwave Studio software. The arch method is used to analyse the performance of the microwave absorber. It contains of a wooden structure in the shape of semi-circular for enabling the proper positioning towards transmitting and receiving the signals through two horn antennas. Bamboo is used as an absorbent material. Carbon from the bamboo charcoal is used to enhance the absorption performance. The expected result for bamboo roofing microwave absorber is to get a high performance of microwave absorption which is above 20 dB. From the measurement conducted all models are capable to absorb the microwave radiation. However, Model C has recorded the highest absorption level.

Keywords: electromagnetic, radiation, absorber, microwave, absorption

1. INTRODUCTION

Microwave absorber is the major component in the anechoic chamber. It is designed to eliminate the reflected microwave signals that will interfere device under test (DUT) performance result [1]. The anechoic chamber is used to measure antenna characterization, electromagnetic interference (EMI), and electromagnetic compatibility (EMC) [2]. Inside the chamber is an array of pyramidal absorbers that guide the propagating incident field to its neighboring absorbers. Electromagnetic waves will be absorbed inside the chamber while incoming signals from outside will be blocked making the space an infinite virtual space that has almost no internal reflections and does not experience unwanted external RF noise. [3]. This study focuses on the effect of different arrangement of corrugated bamboo for electromagnetic shielding. The scope of the study is to design corrugated bamboo roof absorbers with different arrangements based on commercial roof as a reference. Three roof models are developed. The absorption performance is determined through simulation using CST software and measurement using free space arch method. The result shows two of the models give a good absorption performance. Thus, it can be said that bamboo with a certain arrangement can be a material that capable to absorb electromagnetic radiation.

2. MATERIAL AND METHOD

Main material for this research is bamboo and carbon. A few models of the corrugated arrangement bamboo roofing had been designed with different shapes which are Model A, Model B and Model C. Figure 1 shows the prototype of three different corrugated arrangement used in this project. The size for all types is 60 cm width x 60 cm in length. CST software is used to simulate the proposed design. The free space arch reflectivity measurement method is used to analyze microwave absorber performance.

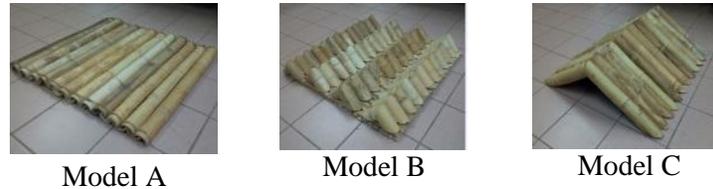


Figure 1. Prototype of Corrugated Bamboo Roofing

3. RESULT

Figure 2 shows a measurement result of the corrugated arrangement bamboo roofing for all models.

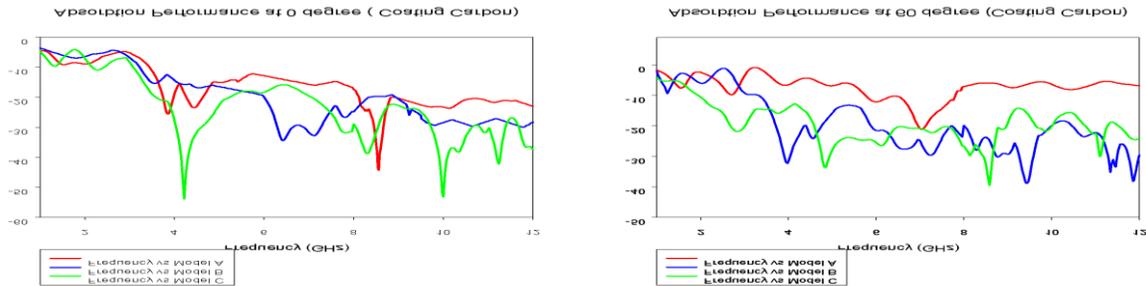


Figure 2. Measurement Result for All Model of Corrugated Bamboo Roofing At 0° And 60°

Table 1 shows the result of average performance of all models measured on difference angle. For every angle of measurement Model B and C show a good average absorption performance.

Table 1. Absorption Performance According to Measuring Angle

Absorber	Average Absorption Performance (dB)														
	0°			15°			30°			45°			60°		
	1-4 GHz	4-8 GHz	8-12 GHz	1-4 GHz	4-8 GHz	8-12 GHz	1-4 GHz	4-8 GHz	8-12 GHz	1-4 GHz	4-8 GHz	8-12 GHz	1-4 GHz	4-8 GHz	8-12 GHz
Model A	-4	-14	-22	-5	-5	-18	-2	-9	-15	-1	-10	-10	-2	-3	-3
Model B	-4	-18	-27	-5	-18	-15	-2	-19	-22	-2	-14	-20	-2	-11	-16
Model C	-6	-18	-30	-5	-19	-20	-7	-20	-20	-9	-20	-19	-3	-20	-14

4. CONCLUSION

The research was conducted on three different arrangement of corrugated bamboo roofing to identify the shape that has high absorption performance. At the measurement level, all models show that the corrugated arrangement bamboo roofing microwave absorber can absorb electromagnetic wave in the range of frequency 1 to 12 GHz. Model C produces the best absorption performance for all measuring angle. Therefore, the goal of this project to compare the performance of the different arrangement is achieved. Increasing the percentage of carbon on the bamboo surface can improve the absorption performance of bamboo roofing microwave absorber.

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Kelulusan daripada pihak YBhg. Profesor dalam perkara ini amat dihargai.

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