

Research on Principle of Electromagnetic Shielding Glass and Information Security Technology

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Abstract: Computers' electromagnetic compatibility and information security are problems that need to be solved urgently at present. However, there are few studies on computer's electromagnetic compatibility, especially leak prevention in China. The development of high performance electric heating electromagnetic shielding glass is mainly to make the screen not only prevent electromagnetic wave from radiating out, but also prevent frosting and fogging, and make the LCD screen work normally at low temperature. The effect of shield thickness on magnetic shielding effectiveness of constant magnetic field is studied by using high permeability metal iron. It is found that the shield thickness increases and its shielding performance increases. Based on the theory of electromagnetic radiation, the electromagnetic radiation of various parts of the computer system is analyzed in detail, and the possibility of leakage of electromagnetic information is obtained. Comprehensively utilizing the electromagnetic shielding characteristics of high magnetic permeability materials, high conductivity materials and high temperature superconducting materials, selecting the optimal electromagnetic shielding scheme to serve the social life and national economy, has important theoretical and practical significance for solving electromagnetic compatibility problems.

1. Introduction

The high-speed development of electronic technology and the wide application of electronic products are an important feature of today's era. With the wide application of electronic circuits and electronic equipment, the problem of electromagnetic compatibility is becoming more and more prominent. In the present and future century, information will become an indispensable and important resource [1]. The power of the control signal is close to the power of external electromagnetic noise, which can easily cause misoperation, sound and image obstacles. The more advanced technology and equipment in the world can receive weak electromagnetic waves emitted from dozens of kilometers and carry out amplification and reduction [2]. For solving various types of electronic products, such as function serialization, noise, image clutter, machine misoperation, electromagnetic obstacles, communication interference, loss of commercial information, radiation damage to human body [3]. Exploring efficient electromagnetic shielding materials, preventing electromagnetic radiation to protect the environment and human health, and preventing electromagnetic wave leakage to protect national security and personal information has become an urgent problem to be solved internationally.

2. Methodology

The electromagnetic wave radiation caused by the alternating current in the information electronic device is different from the electromagnetic radiation generated by the antenna. The antenna is usually created by some engineers through careful design, and has very strong radiation performance, which can radiate almost all the electromagnetic energy fed out [4]. Because computers have two characteristics of high-speed operation and transmission of digital logic signals compared with general electronic devices, their electromagnetic compatibility research has many special attributes. Solving the electromagnetic shielding problem relies on plating a metal oxide

film on the surface of the glass, and connecting the film to the ground through a conductive connection during use to achieve the required shielding effect [5]. A measure of enclosing the electromagnetic interference source with metal shielding material to make its external electromagnetic field strength lower than the allowable value. For the shielding of static magnetic field and low frequency alternating magnetic field, the material with high permeability is used, and the magnetic field is confined in the shield material. When the external disturbing magnetic field enters the cylinder made of high conductivity material, the induced current will be generated in the cylinder, and the magnetic field generated by the induced current is exactly opposite to the direction of the disturbing magnetic field.

Figure 1 below illustrates the relationship between load and conductivity of nanofibers (CF and NCCF). The results show that the conductivity of NCCF is higher than that of pure CF at the same mass fraction. The composite with 30 wt% NCCF has the highest electrical conductivity of 1313 S/m, indicating that the addition of nano-Ni-Co to CF has a great influence on the electrical conductivity of the composite.

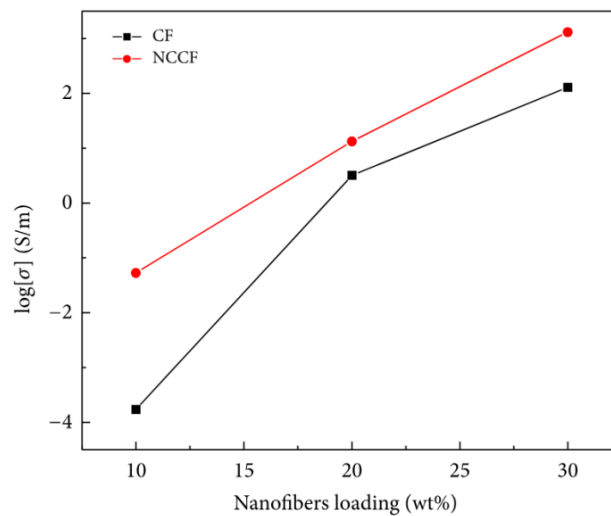


Figure 1 Conductivity of CF and NCCF. All samples are 1.5mm thick

Although the computer is a low-level system, it still poses a serious threat to electromagnetic safety and electromagnetic security. It is common to capture the various kinds of spectra, especially the electromagnetic spectrum, to obtain the required information. This is the concentrated expression of modern technology in investigative technology. However, in order to obtain a smaller resistance value, the thickness of the film layer becomes large, which also directly leads to a decrease in the light transmission property of the entire shield glass. Therefore, the total magnetic field in the cylinder should be the vector sum of the magnetic field generated by the disturbing magnetic field and the induced current. The superposition of the two magnetic fields weakens the actual magnetic field in the cylinder. In addition, by adjusting the micro-structure of the material, the micro-nanocrystalline cluster structure on the surface of the film can be obtained. Its unique quantum effect can promote the ionization of doped impurities.

The effect of mass fraction on the composite value is shown in Figure 2. The experimental results are similar to the conductivity trends of CF and NCCF composites. Based on the above data on conductivity and dielectric constant, the values of CF and NCCF composites increase with increasing weight percentage. This may be related to an increase in the electrical conductivity of the composite.

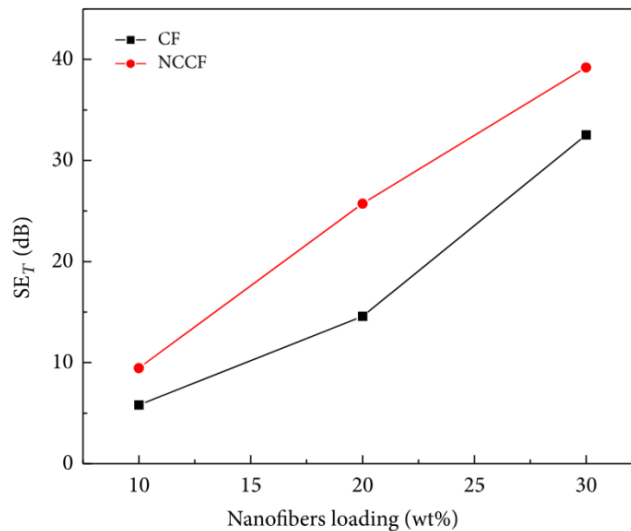


Figure 2 Electromagnetic shielding effectiveness of CF and NCCF composites at 10 GHz. All samples are 2.5mm thick

The positive conductor is surrounded by a complete metal shield, and a negative charge equivalent to the charged conductor is induced on the inside of the shield, and a positive charge equivalent to the charged conductor appears on the outside. In the far field, the electric field and the magnetic field are in phase, and the average Poynting vector is not zero, indicating that electromagnetic energy is radiated outward, so the far field is also called the radiation field. However, the general heat source can not meet the requirements well from the position of the installation or the heating effect. It is greater than the absorption loss. At this time, the reflection loss is the main factor of the shielding effectiveness. As the frequency increases, the reflection loss decreases. In some cases, it is easy to be stolen and interpreted. For high frequency magnetic field, good conductor material should be chosen, and because of skin effect, eddy current only occurs on the surface of the material, so long as the thin metal material can be shielded. The principle is to divide the disturbing magnetic field so that the magnetic lines of the disturbing magnetic field concentrate on the internal magnetic circuit of the material with high permeability, thus greatly reducing the magnetic field intensity in the protected area.

3. Result Analysis and Discussion

In order to reduce the combined interference voltage of alternating electric field to sensitive circuit, a metal shield with good conductivity can be set between interference source and sensitive circuit, and the metal shield can be grounded. Because the computer transmits pulse signals, the system has a wide operating frequency, including medium wave, short wave, ultrashort wave and microwave front section. In addition, even if the heat source is installed, the heat source can only be placed in a corner, heating from one direction to the LCD screen, the uniformity of heating can not be discussed, and the heating effect is not necessarily good. Therefore, the shape of the electric field shield is generally a fully enclosed box-shaped rectangular parallelepiped, and the structural design can be appropriately performed for a special interference source or a shielded device to further reduce the distributed capacitance. The metal casing is affected by the incident plane wave. The incident direction and polarization direction of the plane wave are as shown in Figure 3. The higher the magnetic permeability of the shield, the larger the thickness, the smaller the magnetic resistance, and the better the magnetic field shielding effect. Due to the high speed, high density and logical working state, the transmission line used in the computer often needs to pay attention to the theory of long lines with the characteristics of distributed parameters. Therefore, shielding and matching measures should be taken.

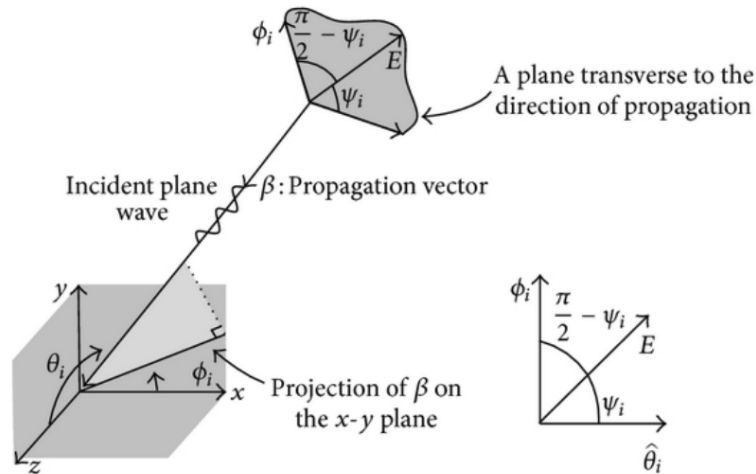


Figure 3 Definition of incident angle and degree of polarization of incident plane waves

Computer is a very complex electronic system. It is a digital system with many kinds and subsystems. The interference and destruction of computer and its data information caused by external electromagnetic radiation, interference between internal components, subsystems and transmission channels. The difference between shielding film and general shielding body is that its thickness is very thin, and the absorption loss can be neglected. The shielding mainly depends on the reflection loss, but the multiple reflection can not be completely ignored. Each mesh of wire mesh can be regarded as a wavelet catheter. The shielded device and the inner wall of the shielding material should have a certain gap to prevent the magnetic short circuit from occurring; the magnetic shielding body is generally grounded to prevent new interference sources generated by the electric field induction. Study the spectrum of electromagnetic leakage that may occur on the motherboard, and cooperate with the near-field measurement technology to truly understand the radiation mechanism of various components on the computer motherboard, and lay the foundation for further electromagnetic compatibility design of the computer.

In addition to electromagnetic interference from electromagnetic radiation, electromagnetic radiation can also cause leakage of electromagnetic information. Because electromagnetic leakage refers to the stray parasitic electromagnetic energy of an electronic device spreading outward through a wire or space. In order to meet the requirements of different use environments and to be able to match the power supply system of the weapon, it is necessary to calculate the resistance value of the corresponding electrically heated film layer. After processing, the output signal is detected by the signal detection chip, and then transmitted to the control part for processing. Therefore, compared with other electronic devices, it has many special attributes in the research of EMC. Among these leakage sources, the maximum and most basic radiation sources are current-carrying conductors. When natural light passes through the screen, it will absorb and scatter, which greatly weakens the transmitted light, so it can effectively prevent glare and reflection, and achieve a soft visual effect.

4. Conclusion

With the development of modern high-tech, electromagnetic interference (EMI) and electromagnetic compatibility (EMC) caused by electromagnetic wave are becoming more and more serious. After noise pollution, air pollution and water pollution, electromagnetic wave pollution has become the fourth major threat to human health. On the basis of electromagnetic radiation theory, the electromagnetic radiation of each part of computer system is analyzed in detail, and the possibility of electromagnetic information leakage is obtained. Based on the research of electromagnetic compatibility theory and computer emission spectrum analysis, a computer electromagnetic compatibility design scheme is proposed. In the traditional printed board design, shielding design, filter design, etc., the electromagnetic radiation and sensitivity of the computer are

better solved. The research results show that different parameters can be used for different shielding bands to obtain shielding effectiveness for different requirements. Choosing the optimal electromagnetic shielding scheme to serve the social life, national economy and national defense industry has important theoretical and practical significance for solving the electromagnetic compatibility problem.

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