СЕКЦИЯ 4
ЭЛЕМЕНТЫ И КОМПОНЕНТЫ СИСТЕМ ЗАЩИТЫ ИНФОРМАЦИИ

FLEXIBLE ELECTROMAGNETIC RADIATION SHIELDS OBTAINED BY CHEMICAL DEPOSITION OF COPPER ON THE SURFACE OF A FABRIC WITH A NANOSTRUCTURED FERROMAGNETIC MICROWIRE

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The samples of the fabrics with the ferromagnetic nanostructured microwire produced by Central Scientific Research Institute for Complex Automation of Light Industry (Moscow, Russia). The composition of the amorphous nanostructured microwire in glass insulation is a ferromagnetic alloy of Fe, Co, Ni and metalloids (B, Si, C). Its content was changed by alternating the weft threads with the microwire. The first sample was without microwire, the second sample was with the alternation of weft threads and microwire at 1:2 ratio; the third sample was with the alternation of weft threads with the microwire at 1:3 ratio and the fourth sample was with the alternation of weft threads with the microwire at 1:4 ratio. The investigation of the characteristics of attenuation and reflection of electromagnetic radiation by such samples was carried out in the frequency range 0.7–17 GHz.

The attenuation by the samples without magnetic particles was close to zero. The attenuation of samples with different quantities of a ferromagnetic microwire is 2…8 dB in the frequency range 2–17 GHz. The reflection coefficient of the samples radiation with different quantities of a microwire was –10…–5 dB in the range 3…12 GHz. While using a metal substrate placed behind the sample, there is a significant increase in the radiation (above 40 dB), which is due to the high (up to 99 %) reflectivity of the metal. At the same time, the change in the reflection coefficient of the radiation samples is up to –10…0 dB in the range 5…14 GHz.

These dependences are explained by the influence of the electromagnetic radiation interaction with the material of the microwire contained in the cotton polyester fabric. At the same time, the mass of the microwire and its shape affect the frequency dependence of the reflection coefficient in the range 2…17 GHz negatively. The chemical deposition of copper on the surface of the fabric fibers was carried out from an aqueous solution containing potassium sodium tartrate, copper sulfate (crystalline hydrate), sodium hydroxide. Formalin with the concentration of 40% was used as a reducing agent. The fabric was placed in this solution, kept in it, then it was washed, dried and stabilized on its surface by clusters of precipitated copper.

It was shown that the reflection coefficient of the fabric is –5…–6.5 dB at the radiation transmission coefficient of –5.5…–7 dB in the range 8…12 GHz. The chemical deposition of copper from an aqueous solution onto the surface of fibers of such a fabric results in decreasing of its reflection coefficient by 0.1…1.1 dB in the range of 8…12 GHz, and in decreasing of its transmission coefficient by 0.2…1.6 dB in the range 8…10 GHz and in increasing this parameter by 0.1…0.8 dB in the range 10…12 GHz.

It was shown that the values of the reflection coefficient of the fabric fixed on the metal substrate are –0.4…–1.2 dB in the range 8....12 GHz. The reflection coefficient of the fabric fixed to the metal substrate after the chemical deposition of copper from aqueous solutions onto the surface of its fibers are reduced by 4…6 dB. Decreasing in this parameter may be caused by the effect of interference damping of antiphase electromagnetic waves reflected from the surfaces of the fabric and the metal substrate.

INFLUENCE OF CHEMICAL COPPERPLATING OF TISSUE WITH NANOSTRUCTURED FERROMAGNETIC MICROWAVE ON ITS COMPOSITION

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The tissue with a nanostructured ferromagnetic microwire is characterized by the reflection and transmission coefficients of electromagnetic radiation in the frequency range 8…12 GHz of –5…–6 dB (at a thickness of less than 1 mm), which is due to the presence of silicon oxides (SiO_2, Si_5O_{10}), brucites ($D_{1,988}MgO_2$, MgH_2O_2), as well as iron niobate (F_6FeNb), characterized by magnetic properties. This determines its application in order to create flexible screens intended for electromagnetic shielding of areas of space in which radio electronic equipment is located.