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Effect of Ferrimagnetic Resonance on Conversion of Electromagnetic Standing Wave Energy into Mechanical Energy

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Abstract—In this paper by means of physical modeling method we obtain the algorithms for calculation of magnetic permittivity in ferrite in case of arbitrary values of magnetic intensity of electromagnetic wave and force of standing electromagnetic wave impact on ferrite cylinder of arbitrary diameter which is placed into constant magnetic field. A value of constant magnetic field intensity provides appearance of ferrimagnetic resonance. It is researched a dependence of a force dependently on distance between metallic shield and ferrite cylinder for ferrimegnetic and spatial resonances. Standing wave forming in a free space with power flow density of 622 kW/m^2 and wavelength of 3.2 cm reflects from metallic shield placed at a distance of $\lambda_0/8 + n\lambda_0/2$, $n = 0, 1, 2, \ldots$ measured from the center of ferrite cylinder and it impacts with force of 10.6 N on ferrite cylinder with a length of 0.64 m with resonance radius of 2.808 mm. Application of spatial resonance and standing electromagnetic wave allows to increase of energy conversion factor of microwave energy conversion into mechanic one 58 times in compare to application of ferrimagnetic resonance only in known papers.

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1. PROBLEM STATEMENT IN GENERAL FORM

Known scientific researches directed to creation of microwave energy converters into mechanic one show appearing of minute driving force which is 1.2 mN/kW [1], 0.6 mN/kW [2], 4×10^{-6} mN/ kW [3]. Main elements of such converters are microwave generator, electromagnetic wave, metallic shield or metallic ring, dielectric ellipsoid and ferrite sphere.

Low level of obtained motive force does not allow to use them in industrial conditions. Therefore development of novel methods of microwave energy conversion into mechanical energy is actual one.

The purpose of the paper is improvement of the method of electromagnetic energy conversion into mechanic energy.

2. ANALYSIS OF LAST RESEARCHES

For improvement of the method of electromagnetic energy conversion into mechanic energy we use the results of following researches.

In [4] it is proposed a method of conversion of heterogeneous electromagnetic wave energy into mechanical energy. A method of conversion lies in converter fabrication from ferromagnetic and impact on this converter with constant and heterogeneous electromagnetic field mutually. At that the value of constant magnetic field intensity corresponds to appearance of ferrimagnetic resonance. Technical result is increase of factor of conversion of electromagnetic energy into mechanical energy.

In [2] in zero approximation it is obtained an algorithm for calculation of a force of electromagnetic wave (power 10 W) propagating in rectangular waveguide with cross-section of 10×23 mm^2 impacts with force of 6 ± 0.5 μN on ferrite sphere with diameter of 3.05 mm placed in constant magnetic field whose value

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

ADDITIONAL INFORMATION

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