TA011
BIOCHEMISTRY AND BIOMEDICAL APPLICATIONS

RF RADIATORS FOR HOMOGENEOUS HEATING

Yu. N. Pchelnikov*, Senior Scientist, Raisa M. Dymshits, Executive Director, SloWaveS, Inc., 104 Drexelbrook CT, Cary, NC 27519, USA.

A successful realization of microwave radiators for physiotherapy [1] confirmed very high effectiveness of a novel method of electromagnetic energy radiation into materials with high permittivity [2]. This method is based on the difference between electromagnetic wave velocities in a human tissue and in a section of a slow-wave structure (SWS) taking place of a radiator. In a free space, slow electromagnetic wave propagates along SWS without radiation, its field concentrating near the surface of the SWS. In the presence of an electro-dynamically dense material, adjacent to the SWS with a small gap, the field distribution changes, and a part of electromagnetic energy propagates in this media in the same direction. As soon as the phase velocity of the slow wave in the SWS exceeds the light velocity in the adjacent media, the energy, propagating in the adjacent material, splits from the wave in the SWS and is radiated. Intensity of the radiation and its direction depend on velocities relation and a gap between the SWS (radiator) and a treated material.

This effect can be used for a biomass or other materials heating. Radiators, being just a section of a SWS can be made with different dimensions and can have different configuration (plane, cylindrical, etc.). Independently of their dimensions, SWS-based radiators can be used at different frequencies.

This paper provides an analysis of a cylindrical radiator intended to sterilize a biomass flow inside a dielectric pipe. A simplified model of a cylindrical SWS (a diaphragm waveguide), filled with a dielectric material, is considered. It is shown that in the radiating regime, the distribution of the electric field in the dielectric material can be adjusted to provide a homogeneous heating.

The obtained results are generalized for a plane model with two radiators placed in parallel one opposite another. It is shown that a gap between the plane radiators can be filled with a treated material.

The practical designs of radiators with cylindrical and plane configurations are also discussed.

REFERENCES

1. Yu. N. Pchelnikov and V. A. Kholodnyi, Medical Application of Surface Electromagnetic Waves, Bioelectrochemistry and Bioenergetics, 1998, # 47, pp. 283-290.
2. Yu. N. Pchelnikov, Radiation of Slow Electromagnetic Waves in a Magnetic Insulator, Journal of Communications Technology and Electronics, 1995, Vol. 40, # 6, pp.25-30.