

Accepted Manuscript

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PII: S1359-4311(17)37274-5
DOI: <https://doi.org/10.1016/j.applthermaleng.2018.05.122>
Reference: ATE 12261

To appear in: *Applied Thermal Engineering*

Received Date: 22 November 2017
Revised Date: 7 February 2018
Accepted Date: 28 May 2018



Please cite this article as: H. Zhu, J. He, T. Hong, Q. Yang, Y. Wu, Y. Yang, K. Huang, A Rotary Radiation Structure for Microwave Heating Uniformity Improvement, *Applied Thermal Engineering* (2018), doi: <https://doi.org/10.1016/j.applthermaleng.2018.05.122>

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A Rotary Radiation Structure for Microwave Heating Uniformity Improvement

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Abstract: A novel microwave heating method with rotary radiation structure has been proposed to improve heating uniformity. Through time division of the whole heating process, static heating assumption of each time step and temperature inheritance between time steps, a simulation model has been built and computed based on the finite element method combined with programming. A quantitative validation of simulation results has been performed with physical experiments. Heating uniformity and heating efficiency of the proposed method has been compared with those of two traditional methods, by which a potato slice is heated with a turntable and heated statically. The results show that the rotary radiation structure has an obvious superiority. What is more, influences of positions of the waveguide that feeds microwave and its placing directions of the proposed method have also been discussed.

Keywords: microwave heating; rotary radiation structure; heating uniformity improvement; efficient heating.

1. Introduction

Traditional heating methods are mainly based on principles of heat radiation, convection and conduction. Materials are thus heated in an outside-in orientation. On the contrary, the burgeoning microwave heating technology processes materials through direct interaction with the inner polar molecules and charged particles of materials. Due to its unique heating principle, microwave heating is characterized by efficient heating, internal heating and environmentally friendly heating [1-5].

However, there are also some natural drawbacks of microwave heating and non-uniformity heating is the most common one [6]. Non-uniformity heating can easily cause local overheat problems and hot spots, which lead to thermal runaway problems as a surge in the system temperature, which will cause quality degradation of final products [7-10] and even cause the burning and

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