New microwave resonant applicator vs multimomode and monomode applicators

D. Ghimpețeanu [1], V. Lavric[2], I. Călinescu[1], M. Pătrașcu[3]

[1]*University Politehnica of Bucharest, Faculty of Applied Chemistry and Materials Science, Bioresources and Polymer Science Department, 1-7 Gh. Polizu Str., 011061, Bucharest, Romania*
[2]*University Politehnica of Bucharest, Faculty of Applied Chemistry and Materials Science, Chemical and Biochemical Engineering Department, 1-7 Gh. Polizu Str., 011061, Bucharest, Romania*
[3]*CHEMSPEED SRL, București, 2 Gara de Nord Str., 010856, Bucharest, Romania*

Process intensification is the development of new equipment and techniques that bring considerable improvements in production and processing. We present the performances of a new applicator based upon two concepts: resonance and focus of the electromagnetic field on the target. At resonance frequency, the cavity stores the MWs energy – therefore, no MWs will be reflected back into the wave guide. The focusing capacity of the applicator is measured with the liquid absorbed power yield, ηPL, defined as the ration between the total power dissipated in the liquid phase and the total power introduced in the applicator. Closer to one the values of the yield, higher the applicator capacity to focus the MWs energy on the target. In the case of MWs with a frequency of 2.45 GHz and TE_{10} mode, the smallest resonant cavity is a cube with the side equal to 86.525 mm. Unfortunately, when placing a load in the resonant cavity and attached a wave guide to it, the interactions matter-electromagnetic field will change the latter, increasing the energy reflected back. Starting from the aforementioned side, the dimensions of the new applicator were searched such that the liquid absorbed power yield to be maximum – the corresponding new side is 145.26 mm. This new applicator was tested for several liquids with very different loss tangent magnitudes and temperature behavior, namely water, ethylene glycol, cyclohexane, acetic acid and 2-propanol.

Acknowledgment
The authors acknowledge the financial support received from the Competitiveness Operational Programme 2014 - 2020, Action 1.1.4: Attracting high-level personnel from abroad in order to enhance the RD capacity, ID project: P_37_471, MY SMIS 105145, Ultrasonic/Microwave nonconventional techniques as new tools for nonchemical and chemical processes, financed by contract: 47/05.09.2016.