

CYLINDRICAL APPLICATOR FOR MICROWAVE HEATING OF FLUIDS

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This paper presents the design for a tailor-made applicator for microwave processing of continuously flowing fluids material. The proposed applicator is designed for use at high temperature for fluids with or without chemical reaction based on a coaxial structure. It operates at 2.45 GHz which is in Industrial Scientific and Medical (ISM) frequency bands.

The applicator is equipped with a central core and a metal outer wall, the interior is filled with SiC cylinders with internal channels for the circulation of fluids.

The design is performed with the aid of electromagnetic simulations, based on a finite-difference time-domain method. No phase change occurs during the heating process. Physical and dielectric properties of material were temperature dependent. The electromagnetic design is based on the dielectric properties of the different material measured in the relevant temperature range. It is verified over the full range of the expected permittivity. This numerical study was performed by COMSOL software. Simulation results are initially validated with experiments and a good agreement is achieved.

Simulation results show that a homogeneous heating of the process material along propagating wave direction. The achieved design provides high energy efficiency with a reflected power of less than 6% without matching device. It is robust against changes in the permittivity of the reactants.



Fig. 1. Tailor-made applicator.

References

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