PREPARATION OF UNIFORM NANOPARTICLE OF METAL PHOSPHATES BY MICROWAVE IRRADIATION

Zhang Wenmin

Department of Chemistry Anhui Normal Univesity Wuhu 241000

Abstract Different metal phosphates have a variety of uses including pigments, catalysts and bioceramic materials. For example, cobalt phosphate is a good catalyst for dehydrogenation、dehydration and isomerization reactions.

This work describes a new procedure, microwave irradiation, for the preparation of uniform spherical metal phosphate nanoparticles. In a standard preparation procedure a beaker containing metal sulfate, sodium phosphate monobasic (NaH_2PO_4), urea and dodecyl sulfate (SDS) was placed in a microwave oven. After microwave irradiating for 4-5 min, followed by aging for some times. The dispersion was then centrifuged and dried. FTIR、 TEM、 PS and DTA characterized the final nanoparticles.

On the basic of the experiments performed in this study, we make the following conclusions:

1> The metal phosphate nanoparticles were prepared by microwave irradiation, which can not get by conventional heat method in the same prescription. Microwave irradiation obviously accelerated precipitation reaction from decomposition of urea at elevated temperature. The particle size was influenced by amount of SDS. The dried samples were determined and its composition consistent with $Co_3(PO_4)_2 4H_2O$, $AlPO_4 2H_2O$, $BiPO_4 5H_2O$ respectively. The nanoparticles are spherical. The aluminum phosphate particles have many small porous and are good adsorbents.

2> The micro agitation effect of microwave protected nanoparticles effectively from the aggregation among the primary particles. Therefor we can get nanometer particles easily under the microwave irradiation.

3> From preparation experiments it was observed that under the microwave irradiation spherical $Co_3(PO_4)_2 4H_2O$ nanoparticle can be obtained while in a conventional heat method a big platelet crystal was obtained. This phenomenon can interpreted as following: in general a polar molecule absorbs microwave more strangely than nonpolar ones, therefor in the microwave field, $Co_3(PO_4)_2 4H_2O$ is more stable than $Co(NH_3)_4PO_4XH_2O$, so we get former but later under the microwave irradiation. The conclusion is that a thermodynamic system tends to decrease the polarity of molecules in the microwave field.

Keywords: microwave irradiation, nanoparticle, metal phosphate

References

1 Ishihawa T., Matijevic E., *J. Colloid Interface Sci,* 1988, 123:122

2 Kandon K., Nakashima H., Ishikawa T., *J. Colloid Interface Sci* 1993,160:499-501

MICROWAVE-CONVECTIVE DRYING OF DISCRETELY NON-HOMOGENEOUS MATERIALS: KINETICS AND QUALITY ATTRIBUTES

E. Sanga[1], A. S Mujumdar[1] and G. S. V Raghavan[2]

1 Department of Chemical Engineering, McGill University, 3610 University St, Montreal QC, Canada H3A 2B2
Tel (514) 398 7632; Fax (514) 398 8387; E-mail: esanga@po-box.mcgill.ca

2 Dept. of Agricultural & Biosystems Engineering, Macdonald Campus, McGill University, 21,111 lakeshore road, Ste-Anne-de-Bellevue, Quebec (Montreal), Canada H9X 3V9

Abstract:

The application of microwave energy in drying processes has been studied widely by various researchers but little is understood about the effect of microwave fields on drying kinetics and the quality attributes of discretely non-homogeneous materials. In this research cylindrical carrot and potato samples (12.7 mm & 25.4 mm in diameter and 25.4 mm long) were used as model materials. To form a discrete non-homogeneous material, both samples were embedded with cylinders of either minimally or highly lossy materials (12.7 mm & 6.3 mm in diameter and 25.4 mm long) and dried under combined microwave-convective conditions. Experimental results on the effect of microwave power level on the drying kinetics and temperature distribution in the samples were continuously recorded. Both quality and physical attributes were studied. The radial and longitudinal shrinkage of the samples were measured during the drying experiments. Color and shrinkage of the samples under different drying conditions were monitored as a function of the moisture content. It was shown that the efficiency of microwave energy utilized for evaporation first rose to a peak and then decreased monotonically with reduction in the product moisture content.

NUMERICAL FIELD DISTRIBUTION STUDY IN A LOADED MONOMODE CAVITY

Qiu Jie* Sun Mingyi Jiang Hanbao

Department of Radio Electronics, Sichuan University, Chengdu 610064)

Abstract

Compared to a multimode cavity, a monomode cavity has following unique advantages:

(1) A monomode cavity can provide much higher electrical field (E-field) intensity.

(2) A monomode cavity has several areas in the cavity where the E-field is uniform.

(3) Measuring the reaction temperature in a monomode cavity is easier than in a multimode cavity.

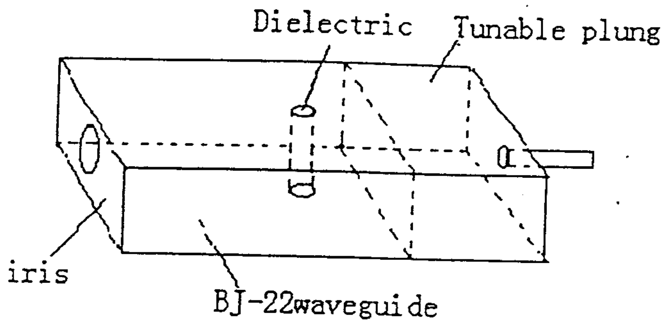

Fig. (1)

Due to these advantages mentioned above monomode cavities have been widely used in chemical synthesis, ceramic sintering and polymer processing. But it is still needed to know how the E-field changes when the permittivity of the loaded material is changed.

Using FDTD method, this paper presents the E-field distribution in the cavity when loaded with different dielectrics. Fig(1) shows the TE103 mode cavity used in this paper. Fig(2) shows the E-field distribution inside the cavity when the cavity is empty. The optimum resonance occurs when the cavity is 222mm long and the width of the iris is 18mm. Fig(3) is the same as Fig(2), but loaded a dielectric (ε *=2-j0.1) in the center of the cavity. The optimum resonance changes to following : the length of the cavity is 220mm, the width of iris is 20mm. The Q-factor is 880. Fig(4) is the same as Fig(2), but loaded with a dielectric (ε *=14-j0.5). The optimum resonance changes again to following : the length of cavity shortened to 188mm. the width of the iris widened to 34mm. The Q-factor reduces to 113.

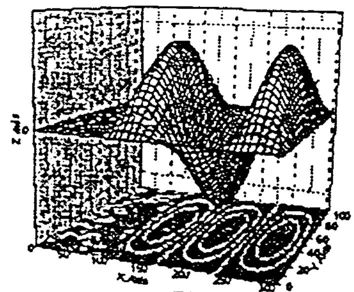

Fig.(2)

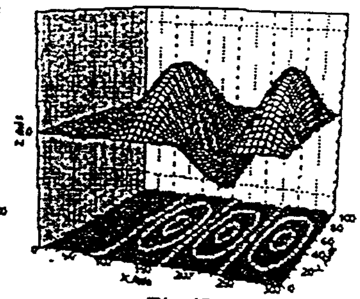

Fig.(3)

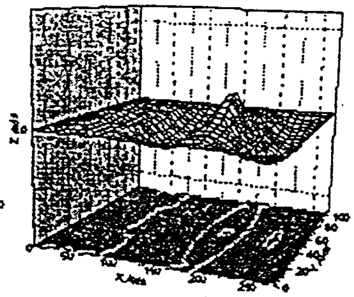

Fig. (4)

The results above shows that when the dielectric constant ε' is increased the length of the cavity should be shortened, and the loss factor ε'' is increased, the width of the iris should be widened in order to keep the cavity in optimum resonance.

ON THE PROBLEM OF THE EQUATIONS SYSTEM OF MICROWAVE CHEMISTRY

A. Brykov, L. Rikenglaz

Saint-Petersburg State Institute of Technology, Russia

Many papers devoted to microwave chemistry, i.e. application of microwave heating for promoting chemical syntheses, have appeared last fifteen years. Most of them include descriptive data, and hypotheses on influence of electromagnetic field on chemical reactions put forward in some papers are not confirmed. No any complete theoretical calculations are present.

In our opinion, all chemical effects under microwave radiation observed hitherto are only the result of temperature rising due to volume sources of heat created because of absorption of electromagnetic energy by the material. These effects can be explicated in terms of solution of a system of interrelated nonlinear partial differential equations which describe reaction kinetics, electromagnetic and temperature fields, mass transfer and other phenomena.

We have found the solutions of this system for so different problems as the carrying out solid-state reaction of isomerization in a waveguide, where a reaction vessel is placed within waveguide, and the drying of alkali silicate solutions in microwave cavity. In both cases, a good agreement between predicted and calculated data was occurred.

OXIDATIVE DEPROTECTION OF TRIMETHYLSILYL AND TETRAHYDROPYRANYL ETHERS, DEOXIMATION AND DESEMICARBONIZATION USING SUPPORTED AMMONIM CHLOROCHROMATE UNDER MICROWAVE IRRADIATION IN SOLVENT FREE CONDITION

M.M. Heravi, Y.Sh. Beheshitiha, R.Hekmatshoar, N.Sarmad

Department of Chemistry, School of Science, Azzahra University, Vanak. Tehran. Iran. Email: mmheravi@azzahra.ac.ir

Ammonium chlorochromate supported in either silica gel or montmorillonite K-10 has been prepared and used for the direct oxidative deprotection of trimethylsilyl and tetrahydropyranyl ether under microwave irradiation in solventless system. Under microwave irradiation and in solvent free condition these supported reagents have also been used for the oxidative cleavage of oxime and semicarbazones.