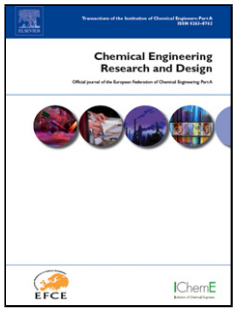

Title: Modeling the solidification of O/W-emulsion droplet in solvent evaporation technique

Authors: Ting Shao, Lin Bai, Binhang Yan, Yong Jin, Yi Cheng

PII: S0263-8762(17)30252-6
DOI: http://dx.doi.org/doi:10.1016/j.cherd.2017.04.022
Reference: CHERD 2659

To appear in:

Received date: 29-9-2016
Revised date: 7-4-2017
Accepted date: 19-4-2017

Please cite this article as: Shao, Ting, Bai, Lin, Yan, Binhang, Jin, Yong, Cheng, Yi, Modeling the solidification of O/W-emulsion droplet in solvent evaporation technique.Chemical Engineering Research and Design http://dx.doi.org/10.1016/j.cherd.2017.04.022

Modeling the solidification of O/W-emulsion droplet in solvent evaporation technique

Ting Shao[1,2], Lin Bai[1], Binhang Yan[1], Yong Jin[1], Yi Cheng[1*]

[1]*Department of Chemical Engineering, Tsinghua University, Beijing 100084, P.R. China*

[2]*Research Center of Laser Fusion, CAEP, P.O. Box 919-987, Mianyang 621900, China*

[*] Corresponding author. Tel: +86 10 6279 4468; Fax: +86 10 6277 2051.

E-mail address: yicheng@tsinghua.edu.cn (Prof. Y. Cheng).

Highlights

- Proposed a new method to numerically study the solidification of a droplet
- Developed a novel numerical method to capture the shrinkage of the droplet correctly
- Provided a deep insight into the details of mass transfer during this process
- Revealed several factors influencing this process from micro-scale point of view

Abstract

The removal of organic solvent plays an important role in the fabrication of polymer spheres by emulsion-based solvent evaporation technique. Mathematical model describing the mass transfer of fluorobenzene (FB) inside the O/W emulsion droplet, from the droplet to the continuous phase and from the continuous phase to the atmosphere to produce millimeter-sized polystyrene (PS) spheres was established. A novel approach based on finite volume method was developed to numerically solve the mathematical equations concerning the shrinkage of the solidifying droplet. Using this method, the variations of the droplet size and the concentration field inside the droplet were captured. The details of the solidification process which cannot be obtained