Abstract

iMedPub Journals
www.imedpub.com

Journal of Biomedical Science and Applications

2021
Vol.5 No: S3

Development of Hydrodynamic flow-focusing droplet generator for preparation of mono-disperse CeO2 microspheres

Satyajeet Yadav*

Department of Chemical Engineering, Institute of Chemical Technology (ICT), Matunga, Mumbai, India

Abstract

Sol-gel-based processes provide powderless routes for the fabrication of nuclear fuel in a specific geometric shape. Oxides, carbides, nitrides, and silicides of uranium, thorium, and plutonium and their solid solutions have been used as nuclear fuels in various reactors. The fuel materials are prepared in the form of microspheres which are used for the fabrication of sphere-pac fuel pins and pellet fuel pins. The required diameter of the wet microspheres for the fabrication of a sphere pack fuel pin for a typical fast reactor was 500 and 2100 µm, which is expected to shrink to 100 and 700 µm respectively after subsequent washing and heat treatment/sintering step as shown in Figure 1. Despite the potential advantages of sphere-pac fuel, sol–gel-based methods are yet to reach the realm of commercial fuel fabrication. This is due to mechanical & voidage concerns regarding the fuel pins fabricated through vibrcompaction of sol-gel derived microspheres. In the sphere-pac fuel pin, two or more size fractions of microspheres are needed to be vibrocompacted to achieve a smeared density of less than 80% of the theoretical density. Microsphere for sphere-pac fuel pin requires to meet stringent quality control requirements concerning dimensional tolerances and surface defects. Thus, there is a need for a unique process capable of producing, two (or more) size fractions of microspheres with desired properties. Microfluidics integrated with sol-gel processes is introduced in preparing monodisperse ceramic nuclear fuel microspheres using nonactive cerium as a surrogate for plutonium. The effects of the flow rate of the continuous and dispersed phase on the size and size distribution of Cerium microspheres were investigated. A comprehensive characterization of the Cerium microspheres has been conducted, including the X-ray diffraction pattern, FTIR, SEM, and BET. The size of the prepared monodisperse wet microspheres can be controlled precisely in the range of 500 to 4000 micrometers, which after heat treatment shrinks to 100 to 1000 micrometers and the Cv is below ±3%.

Biography:

Dr. Satyajeet Yadav is working in Department of Chemical Engineering, Institute of Chemical Technology (ICT), Matunga, Mumbai, India.