5 ton·cm^{-2} pressure, and then the pellet was put in a tantalum capsule. Finally the reduction was carried out at 1 600 ℃ in flowing argon in a sintering furnace.

The product was analyzed by XRD, SEM, and Raman measurements. Fig. 1 shows the X-ray diffraction result for the UC synthesized by carbothermic reduction in the study. It is clear that the product consists of 98% UC and slight UO_2. As shown in Fig. 2, the product UC was porous.

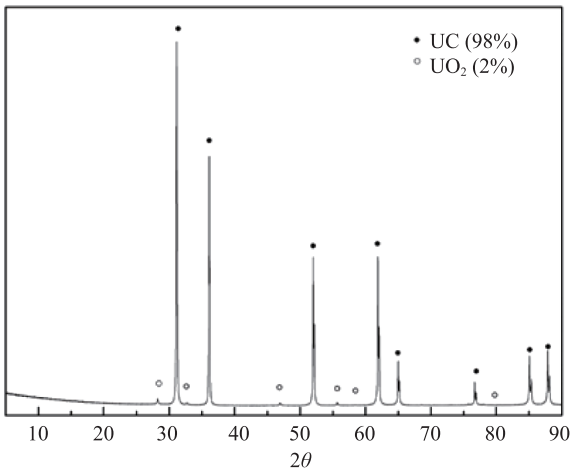

Fig. 1 (color online) XRD pattern of the product.

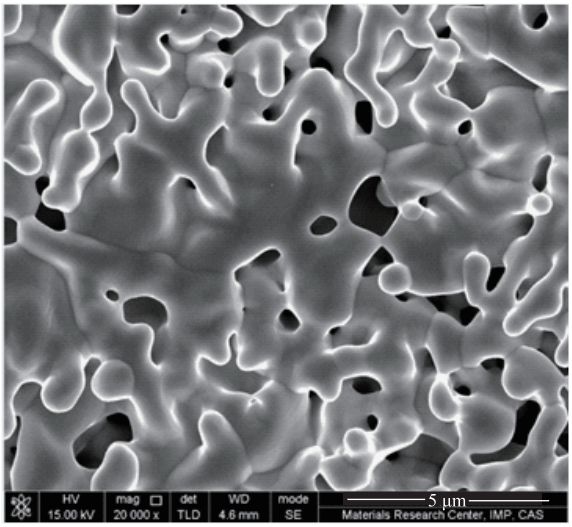

Fig. 2 (color online) SEM of the product.

2 - 30 Manufacturing of Uranium Microspheres Using Improved Internal Gelation Process

Li Sa and Qin Zhi

Preparation of UO_2 microspheres is the basic work for ceramic fuel. Many workers had paid attention on it. In 1970s and 1980s, United States Department of Energy had conducted numerous studies on the fabrication of nuclear fuels particles with the internal gelation process [1]. Manufacture nuclear kernels with internal gelation process is the mature method in wet chemical. Internal gelation process has the advantages of high uniform and spherical microspheres can be prepared. In the fabrication process, there are many factors, such as subsequent ageing, HMTA/uranium mole ratio, gelation forming temperature, washing step, heating rate of the calcined and sinter steps, that affect the quality of the microsphere. The solution is stable at low temperature in the traditional internal gelation process, the speed of gelation was controlled by changing the temperature. However, in present work, the gelation was controlled by selecting the suitable mole ratio of HMTA/uranium at room temperature. The equipment used for cooling the UO_2 spheres was not needed which simplify the equipment of the process. By using high performance liquid pump to mix the solution at room temperature, the gel reaction was under control. The basic research work for preparing UO_2 microspheres with the improved internal gelation process was carried out.

The used uranium solution was concentration of 1.0 mol/L, HNO_3 / UO_2^{2+} = 1.6; The temperature of Silicone oil is 70 ℃. Preparation of the uranium microsphere involved several steps. First, the fabrication of the uranium stock solutions (with and without dispersed carbon black) and HMTA-urea[2,3]. The solution with dispersed carbon black were obtained by dispersing 100 g carbon black under mechanical stirring for 1 h and ultrasonic dispersing 2 h[4,5]. Secondly, the feed solution was droplet dispersed into silicone oil at 70 ℃ to cause the occurrence of gelation. The rate of the flow was ADUN=1.2 ml/min and HMEA=1.2 ml/L. In this step, the gelation reaction occurred immediately when the two solution were meet, which was originally two hours in the traditional ceramic process with chilled mixing solution. The gelled microspheres were aged for 20 min in the hot silicone oil. Finally, the microspheres were collected and successively washed with carbon tetrachloride (three times) and carbon tetrachloride for at least 30 min to remove the silicone oil [6]. The other impurities in the microspheres were removed by washing the microspheres with NH_4OH and deionized water. To obtain the uranium microsphere with good quality, many detailed works need to be done in the future to optimize the improved internal gelation process.