ICFRM2007/397
Fabrication of Li$_4$SiO$_4$ Pebbles by Gel-Precipitation Technology

X. Wu, Z. Wen and X. Xu
Shanghai Institute of Ceramics, Chinese Academy of Sciences, 1295 Dingxi Road, 200050 Shanghai, China
zywen@mail.sic.ac.cn

Lithium orthosilicate (Li$_4$SiO$_4$) is considered as a promising candidate as breeder material for fusion reactors due to its high lithium content, high stability and favorable tritium release behavior. The shape the breeder materials adopted was determined by many factors, such as the tritium breeding ratio, the ease of diffusion of tritium, the release of thermal stress and irradiation cracking etc. At present pebble configuration has been recognized as the preferred option in most blanket designs for tritium breeders. In the fabrication of spheres of a ceramic material, there are several methods available: the agglomeration of powders, melt-spraying method, sol-gel process and gel-precipitation process. Li$_4$SiO$_4$ pebbles with satisfying quality have been fabricated by melt-spraying method. But expensive experimental equipment and high temperature restrict the extensive application of the method. Gel-precipitation can be operated at room temperature and no special equipment is needed. The technique has been successfully used to produce lithium aluminate ceramic spheres.

In this work, fabrication of Li$_4$SiO$_4$ pebbles by gel-precipitation technology was first time investigated systematically. LiOH, citric acid and SiO$_2$ (aerosil) were used as raw materials. SiO$_2$ (aerosil) was dispersed in the gel formed by LiOH and citric acid, milky suspension was then obtained and Li$_4$SiO$_4$ pebbles were produced from the milky suspension. The pebbles obtained displayed pure Li$_4$SiO$_4$ phase, exhibited high sphericity, uniform distribution in size, small amount of pores and cracks. Phase transformation with the molar ratio of SiO$_2$/LiOH was investigated. The effect of sintering temperature on microstructure was discussed. The water-based gel-precipitation method for fabrication of Li$_4$SiO$_4$ spheres was simple and convenient to realize mass production.

Number of words in abstract: 262
Keywords:
Technical area: B4. Functional materials Blanket materials
Special session: Not specified
Presentation: No preference
Special equipment: No special equipment