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Li₂Be₂O₃ pebbles prepared via sol-gel method: multifunctional blanket material designed to both tritium breeder and neutron multiplier

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As a notable multifunctional material in breeding blankets, Li₂Be₂O₃ could play a role on both tritium breeder (lithium) and neutron multiplier (beryllium), which is being considered for use in increasing the tritium breeding ratio. However, synthesis of Li₂Be₂O₃ ceramic powder still needs to be further studied, and the preparation of Li₂Be₂O₃ pebble-type breeder has not been reported in recent reports. In this paper, two-step method is carried out: firstly, Li₂Be₂O₃ ceramic powder is synthesized by sol-gel method. Stoichiometric CH₃COOLi and Be (NO₃)₂ are dissolved in distilled water and transfer to a gel by aqueous solution polymerization of acrylamide. Then the nano-sized ceramic powder is observed by sintering process at high temperature in the air. The sintering temperature is established by thermogravimetric/differential scanning calorimetry (TG-DSC). The Li/Be molar ratio of products are detected by inductively coupled plasma atomic emission spectroscopy (ICP-AES). Crystal structure of this powder is characterized by the X-ray diffraction spectroscopy (XRD). Secondly, ceramic injection molding methods in several conditions are used to prepare the Li₂Be₂O₃ pebbles. The ceramic slurry is prepared by milling 85 wt% synthesized Li₂Be₂O₃ powder and 15% polymerizable binder solution (acrylamide and N,N'-Methylenebisacrylamide). Then the slurry is doped to the liquid paraffin with the temperature at 80 °C, and each drop is about 10μL. The liquid drops could be solidified during the sedimentation in the hot oil. The obtained gel balls could transfer into ceramic pebbles after the second sintering and the strength of the pebbles is also measured by mechanical tester. The results show that when the concentration of polymerizable binder solution is selected about 10 wt%, the resulting pebbles had a better spherical shape and a higher strength.

Eligible for student paper award?

Yes

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