High-temperature X-ray CT approach to the vitrification reactions of glass raw materials

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Abstract

Vitirification process of raw materials is known to influence much on the melt behavior in glass melting tank and finally the quality of glass products. In-situ analysis has great benefit to understand physical and chemical behaviors of material on heating, and we are able to use various such techniques at the present owing to the development of basic technologies. High-temperature X-ray Computed Tomography (CT) is one of them, and a powerful tool to provide us macroscopic status and alteration of materials. Especially, quantitative 3 dimensional datasets inform us the shape and volume of target materials. Our group has developed and used high-temperature X-ray CT instrument to understand the vitirification process of glass raw materials; industry glass batches and nuclear radioactive wastes. Batch blanket or cold cap are the places where the glass melts are formed. Reactions of materials produce new solid, liquid and gas phases, and determine the structural changes. Transportation of materials and thermal energy limit the reaction speeds, and total energy and cost consumed in melting. From X-ray CT analyses, we can know details of materials alteration on heating, and understand the effects of structure there on thermal insulating, vitirifcation speed, etc. In this presentation, high-temperature X-ray CT analyses on soda-lime glass batch and nuclear radioactive wastes are reviewed, and a new detailed research result on the reaction phenomena of industry glass raw materials are focused, especially to understand the formulation of 1st liquid phase in raw materials.

Keywords: High temperature Xray CT, vitirification, glass batch, nuclear radioactive waste

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