## TRIAL FABRICATION TESTS OF ADVANCED TRITIUM BREEDER PEBBLES USING

## SOL-GEL METHOD

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Lithium titanate (Li<sub>2</sub>TiO<sub>3</sub>) is one of the most promising candidates among tritium breeding materials because of its good tritium release characteristics. However, the mass of Li<sub>2</sub>TiO<sub>3</sub> decreased with time in a hydrogen atmosphere by Li evaporation and with Li burn up. In order to prevent the mass decrease at high temperatures, Li<sub>2</sub>TiO<sub>3</sub> with added Li (Li<sub>2+x</sub>TiO<sub>3+y</sub>) have been developed as one of advanced tritium breeders.

We have been promoting the development of fabrication technique of  $Li_2TiO_3$  pebbles by the sol-gel method. The fabrication techniques of advanced tritium breeder pebbles have not been established for large quantities. Therefore, trial fabrication tests of advanced breeder pebbles were carried out using previous sol-gel method.

For this purpose,  $Li_2TiO_3$  with added Li was synthesized from proportionally mixed  $LiOH \cdot H_2O$  and  $H_2TiO_3$  with a Li/Ti ratio of 2.2, and then the sol-gel method were selected as the candidate for the pebble fabrication technique of advanced tritium breeders.

This method mainly consists of

- 1) fine grinding of raw material powder,
- 2) mixture of powder and binder
- 3) fabrication of gel-spheres,
- 4) calcined of gel-spheres, and
- 5) sintering.

The characterization of the pebbles made in  $Li_2TiO_3$  with added Li was carried out. The diameter of the pebbles is 1.18mm, and the sphericity is 1.04. The density of the pebbles is about 89% T.D analyzed by mercury intrusion technique. Molar ratio (Li/Ti) of the sintered pebbles evaluated by ICP-AES is 2.12. The molar ratio of sintered pebbles is smaller than the original mixing ratios of LiOH•H<sub>2</sub>O and H<sub>2</sub>TiO<sub>3</sub>. It appears that Li vaporization is generated during pebble fabrication.

It is expected that an advanced tritium breeder with added Li in single phase  $Li_{2+x}TiO_{3+y}$  will be stable under operating conditions, namely in a neutron environment at a high temperatures. Thus, these results show that the pebble fabrication using the sol-gel method is a promising production technique for mass production of the advanced tritium breeder pebbles.



*Figure 1: Advanced tritium breeder pebbles (Li* $_{2+x}$ *TiO* $_{3+y}$  *pebbles).*