Aging of $Li_{2+x}TiO_3$ tritium breeder under Moist Air

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Li_2TiO_3 has been one of the candidates for tritium breeder in D-T fusion reactors. Recently, the modified Li_2TiO_3, which is [Li]/[Ti]>2, has been developed to improve the life-cycle of its. However, the excess lithium in the modified Li_2TiO_3 gives Li_4TiO_4 phase. Almost lithium compounds (e.g. Li_4TiO_4) absorb moisture and carbon dioxide from air or process gases, and LiOH(H_2O) and/or Li_2CO_3 are yielded. Therefore, the aging of lithium compounds under moist air is an important issue. The weight gain of $Li_{2+x}TiO_3$ under moist air was observed to know the aging mechanism.

Li_2TiO_3, $Li_{2.2}TiO_3$ and $Li_{2.4}TiO_3$ were purchased from Kaken Co. Ltd., JAPAN. X-ray diffraction patterns of these samples were measured to determine the phase. The lattice constants of Li_2TiO_3 agreed with the reported values and no impurity phase was observed. On the other hand, $Li_{2.2}TiO_3$ and $Li_{2.4}TiO_3$ consisted of Li_2TiO_3 and some by-products as Li_4TiO_4 and/or LiOH(H_2O). To measure the aging mechanism, these samples were exposed to moist air. Samples were loaded to glass pans and put into the glass vessel equipped with the water reservoir. Subsequently, the vessel was covered with the lid and it was settled at the dim room to maintain the temperature in the range of 299 K to 303 K and 95 % of humidity. The weight gains of samples were regularly measured for 100 days.

The weight gain of Li_2TiO_3 was observed within 1 % by exposing moist air for 100 days. On the other hand, the weight gains of $Li_{2.2}TiO_3$ and $Li_{2.4}TiO_3$ attained 14% and 19 %, respectively. The X-ray diffraction pattern of Li_2TiO_3 after exposing was same as the original one. The patterns of $Li_{2.2}TiO_3$ and $Li_{2.4}TiO_3$ after experiments consisted of major Li_2TiO_3 peaks and minor Li_2CO_3 ones. These results indicated that Li_2TiO_3 phase was durable against the exposure to moist air. However, by-product as Li_4TiO_4 reacted with water vapour and CO_2. The reaction caused the weight gain. By exposing moist air, the modified Li_2TiO_3 eventually changes to Li_2TiO_3 and Li_2CO_3.

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