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XPS analysis on chemical states of Li_4SiO_4 irradiated by 3 keV D_2^+

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ABSTRACT

Li_4SiO_4 will be applied as tritium breeding materials in future fusion reactor. The release behavior of tritium from neutron-irradiated Li_4SiO_4 should be sensitive to the chemical states of lithium, oxygen and silicon on the surface of Li_4SiO_4 with irradiated defects. The present study is focused on the influence of hydrogen isotopes and irradiation defects on surface chemical state of Li_4SiO_4 . The X-ray Photoelectron Spectroscopy (XPS) was compared between non-irradiated Li_4SiO_4 and D_2^+ -irradiated one. It was observed by that the binding energy (BE) of electron for Li-1s, O-1s and Si-2p of non-irradiated Li_4SiO_4 were 60.9 eV, 536.1 eV and 107.1 eV respectively. However new XPS peak for Li-1s at 57.2 eV, three XPS peaks for O-1s (at 536.1 eV, 533.2 eV and 531.3 eV, respectively) and three XPS peaks for Si-2p (at 107.1 eV, 104.2 eV and 99.7 eV, respectively) were observed in D_2^+ -irradiated Li_4SiO_4 . It is considered that the XPS peaks of 531.3 eV and 104.2 eV should be corresponding to O-1s and Si-2p in $-\text{Si}-\text{O}-\text{D}$ while the XPS peak of 533.2 eV should be corresponding to O-1s in $\text{D}-\text{O}-\text{D}$. The formation of $-\text{Si}-\text{O}-\text{D}$ and $\text{D}-\text{O}-\text{D}$ is considered to be due to typical irradiated defects (lithium vacancy, silicon vacancy and implanted deuterium) induced by D_2^+ -irradiation.