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Innovative Technology for 6Li Enrichment using Electrodialysis with Lithium Ionic Conductor

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Tritium needed as a fuel for fusion reactors is produced via neutron capture by lithium-6 (6Li). However, natural Li contains only about 7.8% 6Li, and enrichment of 6Li up to 90% is required for adequate tritium breeding in fusion reactors. In Japan, lithium isotope enrichment methods have been developed to avoid the environmental hazards of using mercury. However, the isotope separation coefficient and efficiency is too low to meet the practical need of large mass production of 6Li.
Therefore, new Li isotope separation technique using a Li ionic superconductor functioning as a Li isotope separation membrane (LISM) have been developed. First of all, I investigated the ionic mobility of lithium isotopes in ionic superconductor. Combing the first principle and the kinetics Monte Calro simulation, I calculate the diffusion constant of 6Li and 7Li.
Furthermore, examinations of Li isotope separation using LISM with electrodialysis ware performed. Because the mobility of 6Li ions is higher than that of 7Li ions, 6Li can be enriched on the cathode side of a cell. Using Li0.29La0.57TiO3 (LLTO) as the Li ionic superconductor was prepared. After electrodialysis, I obtained a maximum of 1.05 for the 6Li isotope separation coefficient. This result showed that the 6Li isotope separation coefficient of this method is the same as that of the amalgamation process using mercury (1.06).

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