

Current Status of R&Ds on Advanced Breeding Functional Materials for JA DEMO activities

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We, the authors, have dedicated ourselves to researching and developing granulation process of breeding functional materials for tritium breeders and neutron multipliers over the past several years. Through trial and error, beryllium intermetallic compounds (beryllides) and Li added Li_2TiO_3 with Li_2ZrO_3 solid solution (LTZO) as 1 mm-pebble, have been successfully fabricated by the rotating electrode process and emulsion process, respectively. And also the optimization for the granulation process has been carried out to improve the yield and the specific properties.

Characterization of beryllide pebbles, including reactivity to water vapor, swelling properties, hydrogen retention, compatibility with other materials, and pebble bed properties, has shown that they are much better than beryllium pebbles. For LTZO pebbles, we found that the tritium release property showed low tritium retention and a high portion of HT when released. Additionally, we optimized the fabrication process to create small-sized pebbles. We found that the compatibility of LTZO with beryllide was much more stable than that with beryllium. For the optimal design of solid breeding blanket, blanket designs using beryllide block were suggested. To make this design a reality, the strength of beryllides needs to be clarified because there is limited data available on beryllides.

In this study, current R&Ds on breeding functional materials in JA DEMO activities, regarding not only pebble fabrication process but also beryllide blocks' mechanical strength. Additionally, the refinement and recycling process of these materials established by the QST will be addressed by applying the innovative refining process with chemical reaction and microwave heating.

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