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P3.188 Numerical influence analysis of the packing structure for ceramic Li4SiO4 and Li2TiO3 pebble beds

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As an integral part of the solid blanket, ceramic tritium breeder pebble bed plays a vital role in tritium breeding during the operation of the fusion reactor. The packing structure of the pebble bed has an impact on its thermomechanical behavior and tritium exaction in the solid blanket, which is actually affected by packing methods, particle size, container size, particle smoothness, particle hardness and so on. Considering the application of pebble bed in helium cooled solid blanket (HCSB) of Chinese Fusion Engineering Test Reactor (CFETR), a randomly packed pebble bed with a 1mm diameter particle is adopted in the HCSB tritium breeder module. The effect of the container size, the friction coefficient and restitution coefficient between the particles on the packing structure of Li4SiO4 and Li2TiO3 pebble beds need to be analyzed for the HCSB. This paper uses Discrete Element Method (DEM) for numerical analysis, and the simulation model similar to the shape of tritium breeding pebble bed in the solid blanket is generated by pouring the particles into the cuboid container under the gravity. The effects of L/d ratios (L means the length of cuboid pebble bed and d refers to the diameter of the particle), friction coefficient and restitution coefficient on packing structure of the mono-sized Li4SiO4 and Li2TiO3 pebble beds are studied. The curves that the value of packing factor of pebble bed varies with those factors were obtained. Besides, the distribution of the local packing factors in the pebble bed and the layered arrangement of particles near the wall were analyzed, which can provide a reference for the design of the solid blanket.

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