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Development of Small Modular Fast Reactor

Fast reactor is the main reactor type of the Generation-IV reactor. It has the characteristics of compact reactor core, modular design and construction, highly safe simplified design, long refueling cycle, strong scalability, diverse operating modes and wide applications, etc. And it can realize proliferation and transmutation, so is the first choice for small special reactors. Liquid sodium has a high specific heat capacity, suitable for high power density core, and perfect compatibility with stainless steel, wide temperature range, low ability to absorb and slow down neutrons, so it is a coolant that is very suitable for fast reactors. Sodium Cooled Fast Reactor (SFR) with sodium as coolant usually has a negative reactivity feedback coefficient, pool design, low coolant pressure, radioactive containment boundary and passive decay heat removal utilizes natural circulation and air convection and other inherent safety. Russia, United States, France, Japan, India and other countries have SFR development plans. The report introduces the development route of multinational sodium-cooled fast reactors and the system structure and design parameters of representative sodium-cooled fast reactors, such as SFR-4S reactor in Japan, PRISM sodium-cooled fast reactor in the United States, and Marvel reactor and Aurora reactor under design and construction. The report analyzes the development trend and strategy of SFR in China, and introduces the key parameters of CEFR, CFR600, CFR1000 and other sodium-cooled fast reactor, as well as the design progress of new-generation test reactors and micro-sodium-cooled fast reactors. In addition, the report presents the challenges faced by SFR - the operation requirement of "plug and pay" mode, the test of long life and high temperature on materials, the reliability of equipment and maintenance-free time and economics challenges.

Country OR International Organization

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