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Recent research progress about the source term study on irradiated graphite spheres of HTR-10

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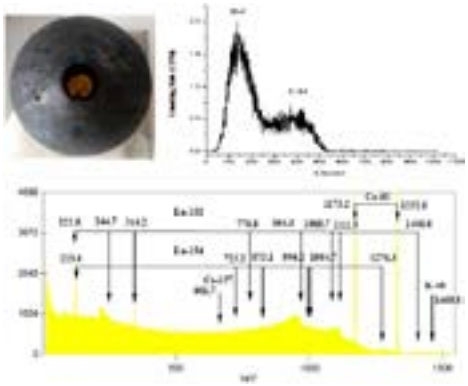
The very high temperature gas cooled reactor system (VHTR), as a development of high temperature gas-cooled reactors (HTGRs), has been identified as a candidate of the generation IV systems for the production of process heat, electricity and hydrogen. For the pebble bed high temperature gas cooled reactor, the performance of the fuel spheres in the core plays a crucial role with regard to nuclear safety. The nuclides produced in the core are the original source of radioactive substances into primary coolant and auxiliary systems in a nuclear power plant. Thus, the determination of the source term in the reactor core can supply important information to understand the behavior of fission and activation products and provide reliable foundation to evaluate the radiation level of the nuclear facility. With previous developed experimental methods which include the preparation and measurement process for the graphite sample, four irradiated graphite spheres from the reactor core of the 10 MW high temperature gas-cooled reactor (HTR-10) have been investigated experimentally. The total β counting rate, the β spectra and the γ spectra for each graphite sample of irradiated graphite spheres were recorded with a total α/β counting measuring apparatus, a liquid scintillation counter and a high-purity germanium detector connected to a multichannel analyzer, respectively. The types of key nuclides in the irradiated graphite sphere of HTR-10 were determined, which were H-3, C-14, Co-60, Cs-137, Eu-152 and Eu-154. The distributions for each nuclide in four irradiated graphite spheres were compared. The generation mechanisms of H-3, C-14, Co-60, Cs-137, Eu-152 and Eu-154 in the irradiated graphite sphere of HTR-10 were discussed and analyzed. A sensitivity analysis was performed to explain the effect of the content of impurities and fraction of natural uranium contamination on the specific activity of key nuclides in the graphite spheres. Current study on irradiated graphite spheres of HTR-10 can provide valuable information for the source term analysis, waste minimization and radiation protection of high temperature gas-cooled reactors (HTGRs).



Biography

Feng Xie is working in Institute of Nuclear and New Energy Technology of Tsinghua University, Beijing, China. His research interests include source term analysis, the behavior of fission products and radioactive graphite dust, atomic molecular physics, and laser spectroscopy. Now, he is In Charge of the design and implementation of the radioactive graphite dust measurement system of the HTR-10, and process and effluents radiation monitoring system of the HTR-PM in China. He has received his Bachelor's degree and PhD in 2003 and 2008 from the Department of Physics in Tsinghua University, respectively. In 2011, he assumed his current position in INET of Tsinghua University.

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