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反应堆工程

10 MW高温气冷堆一回路放射性裂变产物活度测量实验及分析

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摘要 对10 MW高温气冷堆（HTR-10）一回路氦气中放射性裂变产物的组成及活度水平的准确测量，可用以分析研究HTR-10燃料元件释放裂变产物的特征，并可用以推知堆芯所有燃料元件中铀污染水平和燃料颗粒的整体破损率水平，从而可得到HTR-10辐射安全性的直接验证。本工作通过对取样罐氦气中惰性气体核素活度的分析，推测HTR-10一回路活度，并与程序计算值进行了比较。实验测到了^{85m}Kr、^{87}Kr、^{88}Kr、^{133}Xe、^{135}Xe、^{135m}Xe、^{138}Xe、 ^{88}Rb、^{138}Cs等核素。通过实验测量可推知，燃料元件石墨孔隙中的铀污染份额低于5.7×10^{-7}。

关键词 10 MW高温气冷堆 燃料元件 燃料颗粒 破损率 一回路活度

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Experiment and Analysis of Fission Product Activity in Primary-Loop of 10 MW High-Temperature Gas-Cooled Reactor

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Abstract Based on the precise measurements of the activity and component of fission products in the primary helium of 10 MW High-Temperature Gas-Cooled Reactor (HTR-10), the feature of the fission product released from the fuel element was analyzed, meanwhile, the failure fraction of the fuel particle or the U-contamination was directly deduced, and the radiation safety of HTR-10 was proved. The activity of inert gas nuclides in sample was experimentally measured, and the primary radioactivity was deduced. In the experiment ^{85m}Kr, ^{87}Kr, ^{88}Kr, ^{133}Xe, ^{135}Xe, ^{135m}Xe, ^{138}Xe, ^{88}Rb, ^{138} Cs were detected and measured. Through the comparison between the experimental results and the calculated ones, the U-contamination of graphite ball was obtained to be less than 5.7×10^{-7} .

Key words 10 MW High-Temperature Gas-Cooled Reactor _ fuel element _ fuel particle _ failure fraction _ primary radioactivity

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