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10MW高温气冷实验堆硼吸收球停堆系统气力输送模拟试验研究

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摘要 吸收球停堆系统是10MW高温气冷实验堆(HTR 10)的第二停堆系统,于紧急事故停堆之后、重新开堆之前投入运行,利用负压输送过程将在紧急停堆时进入反应堆堆芯落球孔道内的中子吸收球输送到位于堆顶的贮球罐内,实现正常开堆或反应堆再临界。运用气力输送的密相输送理论,对回路各部件和各管段的气固两相流阻力进行计算,并在1∶1模拟试验台架上,以空气和氦气为载体,真实硼吸收球为物料,进行了气力输送试验研究。试验数据与理论分析相符合,吸收球第二停堆系统的气力输送功能满足HTR 10工程的技术要求。

关键词 高温气冷实验堆 气力输送 吸收球停堆系统
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Verification Test of Pneumatic Conveying of Small Absorber Ball System for 10 MW High Temperature Gas-cooled Test Reactor

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Abstract The small absorber ball system is the second shutdown system of the 10 MW high temperature gas cooled test reactor(HTR 10). This system is devoted after the emergent shutdown and before the re open of the HTR 10. When the B 4C balls are transported from the reflector columns of the reactor core to the ball storage vessels on the reactor pressure vessel top by the pneumatic suction conveying process, the reactor can be re opened safely. The dense phase conveying theory is used to calculate the pressure lost of the helium B 4C ball two phase flow. And a pneumatic conveying test is performed by using air(0.22 MPa) and helium(1.6 MPa) as media with real small absorber balls on a full scale 1∶1 loop. Test result data according with the theoretic conclusion prove that the function of pneumatic conveying of the small absorber ball system is capable to perform satisfactorily at operating temperatures of the reactor.

Key words 10 MW high temperature gas-cooled test reactor pneumatic conveying small absorber ball system

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