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HIGH TEMPERATURE REACTOR DEVELOPMENT IN CHINA

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ABSTRACT

Since the late 1970'-s the research and development program on the high temperature gas-cooled reactor (HTR) has been carried out in China. The 10 MW High Temperature Gas-cooled Reactor-Test Module (HTR-10) reached first criticality in 2000 and was put into full power operation in 2003. Six safety demonstration tests were done on the HTR-10. The project of the HTR-10 with a gas turbine cycle is underway. The project of the HTR demonstration plant with a power of around 150 MWe (HTR-PM) is planned. In this paper the HTR development in China is briefly described.

KEYWORDS

HTR-10; HTR; Safety demonstration test; HTR-PM

1. INTRODUCTION

The research and development program on the high temperature gas-cooled reactor in China was started in the late 1970'-s and was part of the China High Technology Program in 1986-2000. The target was to build a 10 MW High Temperature Gas-cooled Reactor- Test Module at the Institute of Nuclear and New Energy Technology (INET) by 2000. In fact the HTR-10 construction started in June 1995, achieved first criticality in December 2000 and reached full power in February 2003. After that six safety demonstration tests were carried out. Meanwhile the project of the HTR-10 with a gas turbine cycle is underway, which is involved at the second phase of the China High Technology Program (2001-2005). In parallel the project of the demonstration plant with a power of around 150 MWe has been planned and is being carried out. In this paper the HTR-10 design is described, the results of safety demonstration tests are shown and the HTR-10 with a gas turbine cycle and the HTR-PM are introduced.

2. HTR-10 DESCRIPTION

The HTR-10 design (see **Fig.1**) represents the features of modular HTR design (Lohnert, 1990). The reactor core and the steam generator are housed in two separate steel pressure vessels which are arranged in a "side-by-side" way. These two vessels are connected to each other by a connecting vessel in which the

hot gas duct is designed. All these steel pressure vessels are in contact with cold helium at about 250°C coming out from the circulator which sits over the steam generator tubes in the same vessel. The HTR-10 key design parameters are listed in **Table 1**. (Sun, 2000)

Table 1. The HTR-10 main design parameters

Parameters	Unit	Value
Reactor thermal power	MW	10
Active core volume	m^3	5
Average power density	MW/m^3	2
Primary helium pressure	MPa	3
Helium inlet temperature	°C	250/300
Helium outlet temperature	°C	700/900
Helium mass flow rate	kg/s	4.3/3.2
Fuel		UO_2
U-235 enrichment of fresh fuel elements	%	17
Diameter of spherical fuel elements	mm	60
Number of spherical fuel elements		27,000
Refueling mode		Multi-pass, continuously
Average discharge burnup	MWd/t	80,000

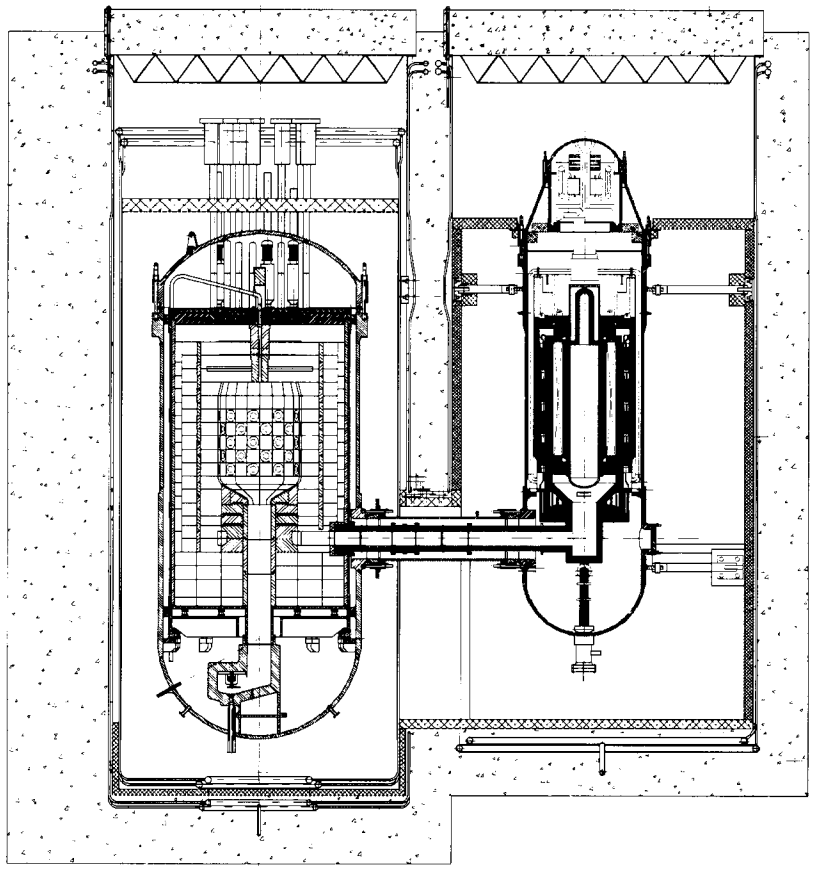

Fig. 1. Cross section of the HTR primary circuit