Primary Experimental Results of an MHD Flow in the Duct with Flow Channel Insert

Zengyu Xu, Chuanjie Pan, Xiujie Zhang, Li Zhao, Jian Zhang
Guoji Yang, Xuru Duan and Yong Liu
Southwestern Institute of Physics
P. O. Box 432, Chengdu, Sichuan 610041, PRC
E-mail: xuzy@swip.ac.cn

Abstract: The ducts with flow channel insert (FCI) as a candidate for liquid metal blankets have been researched and developed many years, and some results coming from modeling codes and simplification theoretical was reported. But up to now, not experimental data is available. In this paper, the primary experimental results of an MHD flow in the duct with FCI are reported. Up to now, this is the only experiment in the world on the FCI flow. The results indicate that velocity profile in core area is complication and changing as a periodicity of the distance between equalization holes (PEH), and as well as that fluid volume in both core and boundary areas and MHD pressure drop are approached to the expectation from simplification theory modeling. These experimental results are useful for liquid blanket design and the modeling developing to analyze an MHD flow in the duct with FCI.

Keywords: Liquid metal blanket, MHD effect, FCI

I. INTRODUCTION

Liquid metal blanket concepts are still an attractive ITER and DEMO blanket candidates as they have low operating pressure, simplicity and a convenient tritium breeding cycle [1-4]. But how to reduce MHD pressure drop are still remained as key issues in these systems, especially in the system of the ducts with a silicon carbide composite (SiCf/SiC) flow channel insert (FCI). Now, some numerical analysis results of MHD flow in a duct with FCI are carried out [5,6], but not the experimental data are available. As the SiCf/SiC suitable for experiment demand difficultly gotten and the SiCf/SiC conductivity varying during the period of the experiment to make a extra difficult of analyzing FCI MHD effect, so, epoxy FCIs and steel FCIs is selected in the experimental investigation on the FCI flow (in here, it is only reported the results on epoxy FCIs flow). In this paper, the conducting experiments of MHD flow in duct with FCI and primary experimental results are presented.

II. EXPERIMENTAL DESCRIPTION

Figure 1 shows the location of the duct with flow channel insert (FCI) in the magnetic field. The duct is made of Type-304 stainless steel (SS) with a cross section of 68 mm by 60 mm (2a2 in length and 2b2 in width) with 2 mm in wall