SURFACE WAVE GROWTH CHARACTERISTICS OF THE HIGH SPEED LIQUID LI FLOW

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This paper reports on the measurement of surface waves on a liquid lithium jet and results of the study of the Li target at the International Fusion Materials Irradiation Facility (IFMIF). To examine an influence of the initial growth of free surface waves, the characteristics of the surface waves at 15mm and 175mm downstream from the nozzle exit were examined experimentally.

Experiments were carried out using the lithium circulation loop at Osaka University [1], with a focus on the free surface oscillations. These oscillations were measured using an electro-contact probe apparatus, which detects electric contacts between the probe tip and the Li surface [1]. The apparatus was installed 15mm and 175 mm downstream from the nozzle exit and was scanned along the liquid-depth direction.

The contact signal was analyzed, and the wave height of the surface waves was examined. The maximum wave height was approximately 1.2 mm at the location of 15 mm from the nozzle exit, though the maximum wave height at the location of the deuteron beam axis reached 6 mm, at a velocity of 15 m/s, as shown in Fig. 1. To examine the characteristics of the wave height distribution, the average wave height, significant wave height, and maximum wave height were determined. It is noted that the wave height ratio of H_{175}/H_{15} as a function of velocity was found to be around three to four and not exceed two or five, as is shown in Fig.2. Characteristics of the wave height distribution were obtained for velocity range of 3m/sec to 15m/sec, and at 15 and 175 mm location. This result implies that the initial growth of free surface waves exerts definite influence on surface wave growth in downstream region.

The present study was conducted under cooperation of JAEA under ITER-BA agreement.

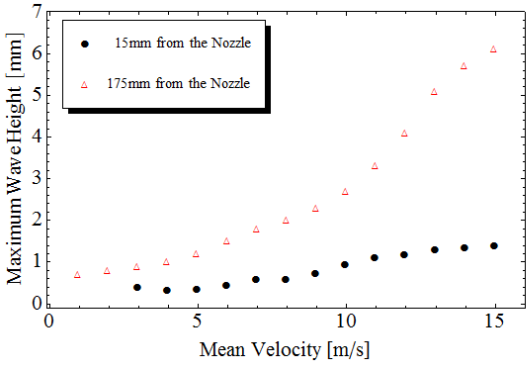

Figure 1: Wave height

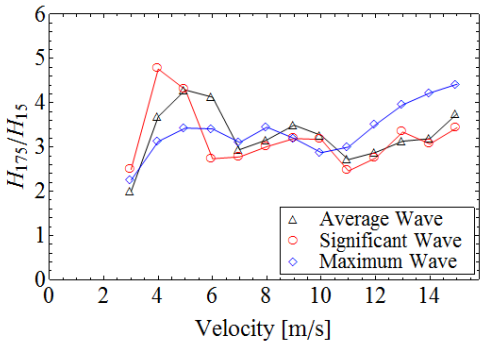

Figure 2: Wave height ratio

[1] Horiike, H., Kondo, H., Nakamura, H., Miyamoto, S., Yamaoka, N., Matsushita, I., Ida, M., Ara, K., Muroga, T., and Matsui, H., 2006, "Free-Surface Fluctuation at High Speed Lithium Flow for IFMIF," Proc. 21st IAEA Fusion Energy Conference, Chengdu, China