Underwater Laser Cutting for Dismantling Nuclear Facilities

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1. Introduction

Laser cutting technology has many advantages in dismantling nuclear facilities. For application to this field, it is necessary not only to be able to effectively cut thick steel, but also to be capable of underwater cutting. In our laboratory, the laser cutting technology was developed with a high power fiber laser and a cutting technique capable of cutting about 15 mm thickness per kW was achieved by performing a study of cutting thick stainless steel and carbon steel plates in air [1-4]. Subsequently, an underwater cutting head was developed and cutting studies have been conducted [5]. In this paper, the experimental results of the underwater cutting was summarized. It was obtained with a 6-kW fiber laser as a cutting source.

2. Experimental Procedure

The underwater laser cutting is performed in the following order. First, place the specimen in the water tank and place the cutting head above the water surface. A small assist gas flows out of the nozzle to prevent water from entering the nozzle, then lower the cutting head to the underwater cutting position. Next, a large amount of assist gas is jetted out of the nozzle and the laser is turned on. The head moves and cutting of the specimen begins.

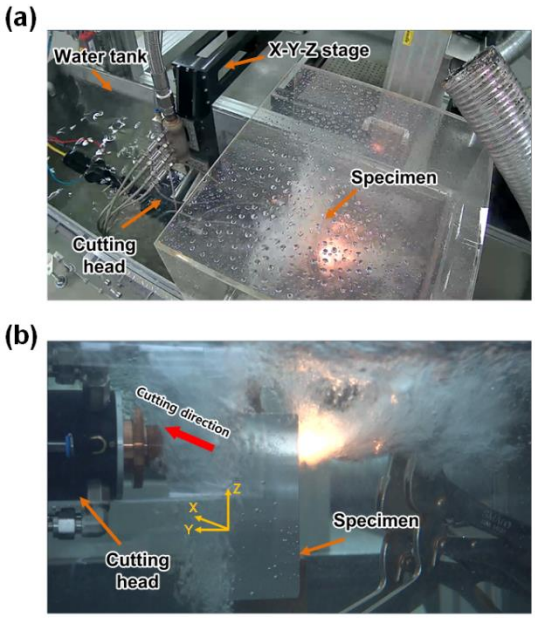

Fig. 1. Views of the underwater laser cutting experiment: (a) whole view, (b) partial side view.

Fig. 1 shows the views of the underwater laser cutting experiment. Fig. 1(a) shows the whole view and Fig. 1(b) shows a partial side view of the cutting progress. The cutting head was completely submerged during the cutting process.

3. Experimental Results

The maximum cutting speeds were measured to be 80 mm/min for the 50 mm thickness and 40 mm/min for the 60 mm thickness. As in ordinary laser cutting, the kerf widths were narrow. For the cutting at each maximum speed, the kerf widths for the 50 mm thickness were 1.6 mm for the front surface and 0.7 mm for the rear surface, and the kerf widths for the

60 mm thickness were 1.5 mm for the front surface and 1.2 mm for the rear surface.

4. Conclusion

Underwater cutting of 50 and 60 mm thick stainless steel plates with a 6-kW fiber laser was performed as a fundamental study for application to dismantling nuclear facilities. It is expected that the results of this study will contribute to the continued development of underwater cutting research for dismantling nuclear facilities.

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