Fatigue Performance of EH40-TM Steel Plate for Container Carrier

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ABSTRACT
A demand for steel plates with high strength and heavy thick plate for the building container carriers has been increased recently. It was evaluated the fatigue strength of butt joints and edge treated specimens fabricated with EH40-TM steel plate with thickness of 80mm, respectively, which are utilized for container carriers. As a welding process, multi-pass FCAW, multi-pass FCAW combined with EGW and tandem EGW were applied. Especially the effect of weld improvements on the fatigue life of butt joints was investigated. The test results were compared with the UK DEn curve.

KEY WORDS: Fatigue Life, EGW, FCAW, Weld Improvement, Butt Joint, Residual Stress, Chamfering, Grinding, EH40-TM Steel Plate, container carrier

INTRODUCTION
Due to expanding container trade, new container carriers more than 10,000TEU have been building recently. Larger container carriers, however, require thicker plates in way of hatch coaming. In this case, higher strength steel plates are desirable instead of thicker plates, because the availability of thicker plates may be limited and the welding fabrication will be more and more difficult. Fig. 1 shows that higher strength steel plates are used in larger container carriers. Upper deck of container carrier requires also the higher strength steel plates in order to load with a lot of containers.

Various welding processes can be applied to the fabrication of the hatch coaming part. It is important to select the economic welding process and to verify its stability. In particular, it is very necessary to guarantee the fatigue life of the weldments in way of hatch coaming. To enhance the fatigue life of welded joint, the weld improvement methods have been investigated (Kirhope et al, 1999). New weld improvement methods, such as spot heating (Park et al, 2006) and ultrasonic impact treatment (Ummenhofer et al, 2006&2007) are applied to the weldments recently. Edge of upper deck should be treated with chamfering or grinding. Edge treatment makes the painting easily and enhances the fatigue performance besides.

EXPERIMENTS
Welding Conditions
EH40-TM steel plate with thickness of 80mm was used for high cycle fatigue tests. As a welding process, multi-pass flux-cored arc welding (hereafter referred to as FCAW) and multi-pass FCAW combined with electro-gas welding (hereafter referred to as EGW) for the double-V-groove welded butt joints and tandem EGW for the single-V-groove welded butt joint were applied. Welding conditions and shapes of layered deposit were shown in Tables 1–3 and Figs. 2–4, respectively. As a weld improvement method, toe grinding and ultrasonic peening were used.