Influences of Shot-Peening on Fine Grain Steels

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ABSTRACT

Recently, fine grain steel has been actively researched. However, as we know, the influence concerning the shot peening processing to fine grain steels has been few reported up to now. Therefore residual stress distribution near the surface of fine grain steel after shot-peening was measured by X-ray diffraction technology. Moreover, the hardening effect the distributed near the shot-peened surface was also estimated. The relationships between the effects of shot-peening and the grain size of material were discussed.

KEY WORDS: Fine grain steel; Shot-peening; Residual stress; Vickers hardness; X-ray; FWHM

INTRODUCTION

Recently, the study of fine grain steels that aims to achieve to high strength is active. Fine grain steel can heighten the yield stress as expected from the Hall-Petch relation. Therefore, the economical design is expected to be realized. Usually, fine grain steel is made by the strong distortion processing. As specimens for this paper, the ratio of extending by rolling is 90% or more. And, the made metal doesn’t add the alloy element. Therefore, material is an excellent material in various characteristics and recyclabilities. And material is expected to be used in various fields in the future.

For instance, it is considered to use for the structure material. Welding is one of the most useful method to connect the structure components. For that case, the negative influence of residual tensile stress that occurred in the welding processing must be considered. It has been proved that the shot peening processing can solve this problem effectively. However, the influence concerning the shot peening processing to fine grain steels has been few reported up to now. In this study, JIS-SM490 and NGF600 were used, and three kinds of specimens were obtained after heat treatment. Residual stress distribution near the surface of fine grain steel after shot-peening was measured by X-ray diffraction technology. Moreover, the hardening effect the distributed near the shot-peened surface was also estimated. The relationships between the effects of shot-peening and the grain size of material are discussed.

Experimental

Annealing processing

SM490 and the minute making the crystal grain equivalent material NFG600 in the rolled steel plate for the welding structure as the specimen are used this paper. However, it should know what influence a average grain size of fine grain steel and initial hardness gives to the shot peening processing. For that reason, We clarified the relation between grain size and Vickers hardness beforehand for that.

Fig. 3 shows the experiment result. This experiment is a result of annealing by 523-1173K, making NFG600 of various grain sizes, and measuring Vickers hardness.

Fig. 1. Relation between annealing temperature and grain size

Fig. 2. Relation between annealing temperature and Vickers hardness.