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PROPERTIES OF LOW-CARBON AS-ROLLED STEEL BARS FOR MACHINE AND STRUCTURAL USE

Hiroo Ohtani
Fukukasu Nakasato

Abstract

New type of as-rolled steel bar products has been developed. They are characterized by an excellent combination of strength, toughness and ductility. The present paper describes a systematic study on the effect of alloying element on the mechanical properties of controlled rolled bars. Trial production test results, the processing and performance properties obtained are also described. The HSLA bars introduced herein can meet the requirements both of manufacturers and users for the complete elimination of the quenching and tempering process conventionally applied on the selected automotive components.

I. Introduction

Recently, as an alternative to the quenched and tempered steel, special attention has been given to as-rolled bar products to be directly machined and/or cold drawn for machine and structural use. The elimination of heat treatment leads to an appreciable cost-saving: energy-saving, shortening of stock period for semi-product and reduction of transportation expenses. For the above usage, medium-C (0.45%C) steels have mainly been applied. The demand, however, for improved toughness and ductility comparable to those of the conventional quenched and tempered steels has led to the recent development of the lower carbon steel bars. The present study describes the properties of low-C (0.25%C) bar products, in contrast with those of the medium-C versions.

II. Experimental Procedure

Table 1 shows chemical composition of the basal steel together with the contents of C, Si, Mn, Cr, V and N individually added to the basal

steel. The 100-kg laboratory heats were prepared for each steel by air melting, and the ingots were forged to 68-mm dia. billets. They were heated to 1180°C and rolled to 22-mm dia. bars on a 15-pass schedule. The finishing temperature was controlled to 940°C. Cold drawing was given up to 33% cross-sectional reduction. Experimental flow chart is shown in Fig. 1.

Table 1. Chemical compositions of basal steel (JIS S25C)

(wt.%)							
C	Si	Mn	P	S	V	sol.Al	N
0.25	0.23	0.75	0.013	0.006	0.091	0.031	0.0098

Variables C: 0.20 ~ 0.36, Si: 0.23 ~ 0.78
Mn: 0.45 ~ 1.55, Cr: Tr. ~ 0.94
V: Tr. ~ 0.36, N: 0.0059 ~ 0.0156

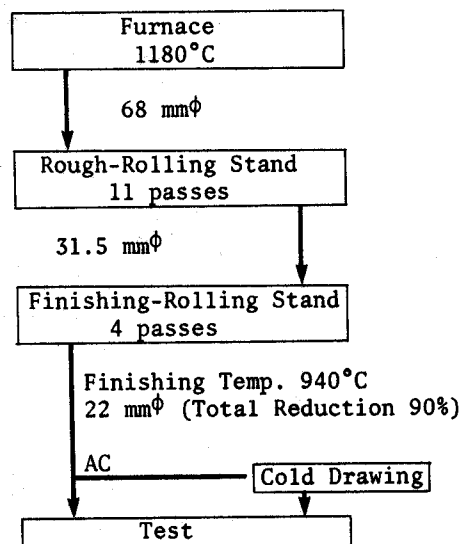


Fig. 1 Bar Rolling Layout