Hot Rolled Steel Sheet with Excellent Deep Drawability, "KFN3"*

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Synopsis:

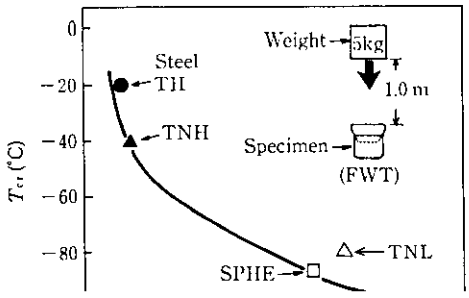
Hot rolled steel sheet with extra-low carbon content which exhibits excellent formability has been newly developed in Kawasaki Steel. Chemical composition of this steel is specially controlled, that is to say, sulfur content is 0.003 wt% or less and titanium is added so that the effective Ti/C atomic ratio will come to more than 1.0. In the hot rolling process, this steel is coiled at a temperature lower than 600°C. The characteristics of this steel are as follows: (1) Total elongation is 55% or higher (3.2 mm thick).

brittleness after deep drawing. In (4), an improvement in resistance to cold-work brittleness can be expected

neither Nb nor Ti is added, high coiling temperatures of 640°C or above are necessary to stabilize the solute N

Table 2 Effects of Ti and Nb addition and coiling temperature on mechanical properties

Steel	YS*1 (kgf/mm²)	TS*1 (kgf/mm²)	$\bar{El}$*2 (%)	$\bar{r}$*2	ΔEl*2 (%)	Δr*2	AI*2 (kgf/mm²)
TH	16.8	28.7	59.6	0.90	−3.8	−0.37	0.0
TL	17.1	29.4	56.7	0.89	−0.5	−0.20	2.8
TNH	17.0	28.8	57.0	0.92	−1.2	−0.15	0.2



*1 YS and TS were tested in the rolling direction.

*2 The average values, El and $\bar{r}$, were calculated by Eq. (1) and

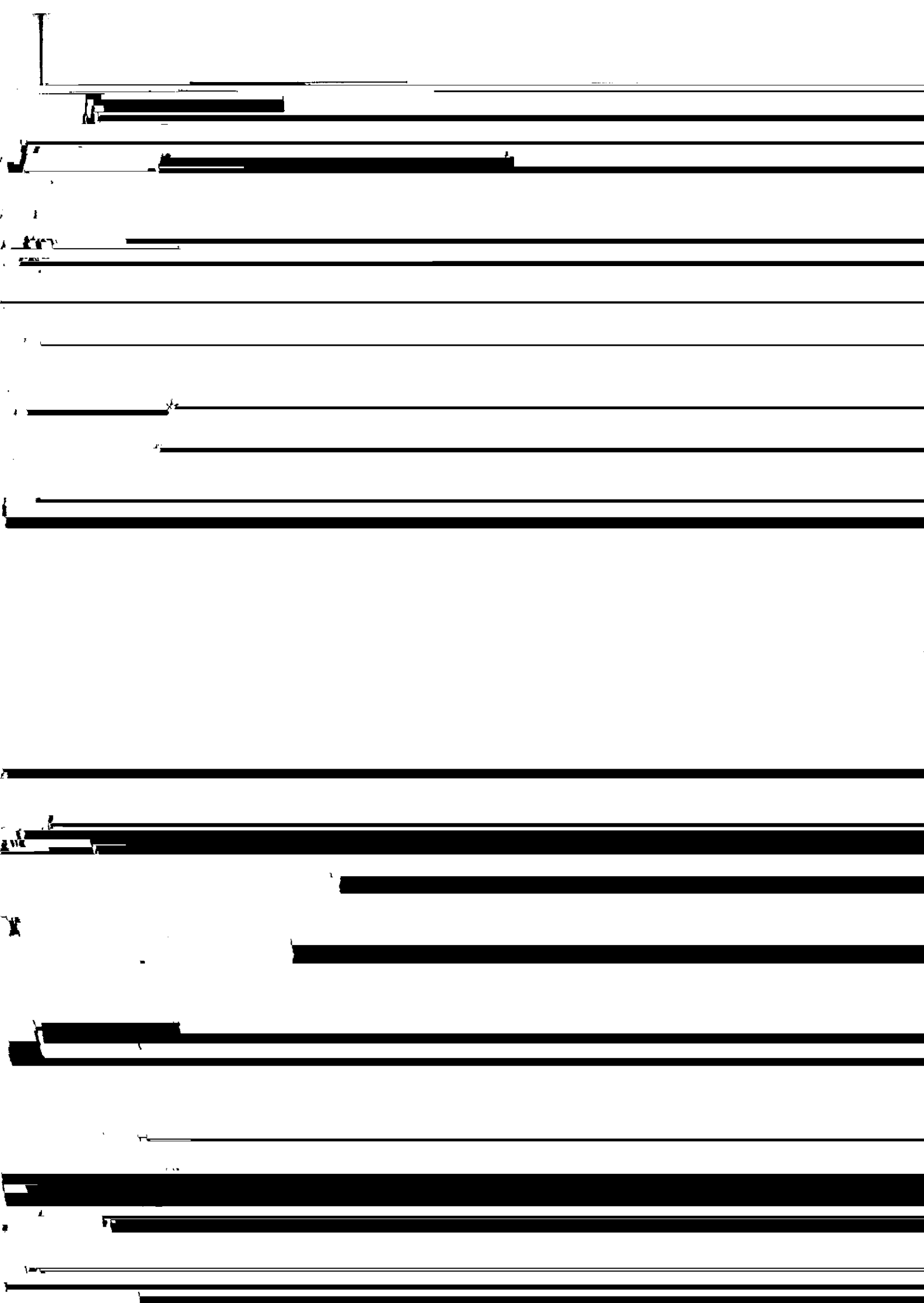
AI (kgf/mm²)

carbon steel with AI of 2.5 to 3 kgf/mm^2 has a resistance to cold-work brittleness equal to or better than that of

to 3.0 kgf/mm^2 indicating that residual solute C amounted to 2 to 5 ppm. Since even Ti- and Nb-bearing

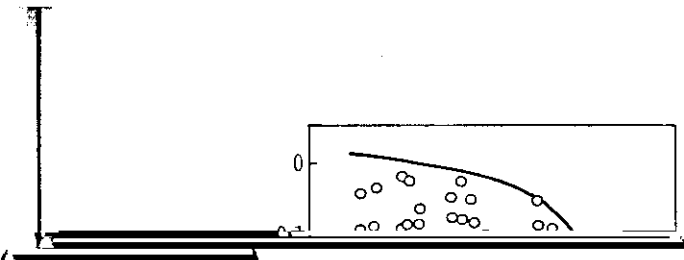
that the atomic ratios of effective Ti to C (Ti*/C) are

50 | 10°C/s | T_h(°C), 5 min |

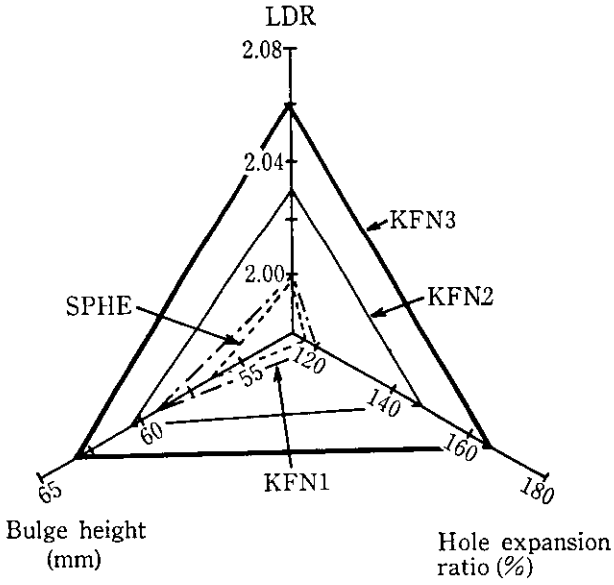


Shear plane Fracture plane

and working temperature are involved, and it is difficult



hot-rolled steel sheets, i.e., SPHE (low-carbon Al-killed steel), KFN1 (B-bearing low-carbon Al-killed steel), and KFN2 (B-bearing ultralow-carbon Al-killed steel).



hole expansion ratio, of KFN3 with those of SPHE, KFN1 and KFN2 (3.2 mm thick)

6 Conclusions

The extradeep-drawing-quality hot-rolled steel sheet

Low Carbon-Niobium Steel with Ultra-deep Drawability",