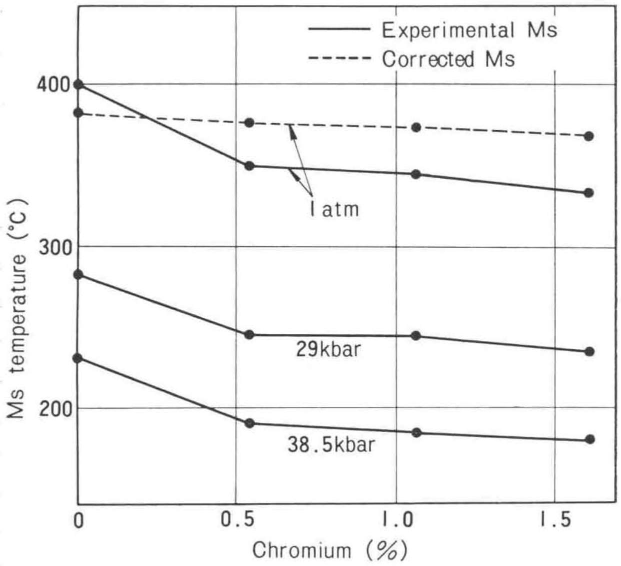

Fig. 1. The Ms temperature in Fe-C-Cr alloys under various pressures. The broken line shows the Ms of Fe-C-Cr alloys at latm corrected at the carbon level of 0.3%C by the Steven's equation[19].

29 and 38.5 kbar are shown in **Fig. 1** and **Fig. 2.** **Fig. 1** shows the change of Ms-temperature by the addition of Cr under various pressure. As the content of carbon in Fe-C-Cr alloys used in this experiment was slightly fluctuated, the Ms-temperatures of those alloys measured at latm were corrected at the carbon level of 0.3%C by Steven's equation[19] and the results were indicated by a broken line in this figure. It is shown in this diagram that the lowering of Ms-temperature with the increase of Cr is essentially the same for various pressures. The pressure dependence of Ms-temperature in the alloys which contain the maximum amount of alloying elements in this experiment is shown in **Fig. 2.** It is shown that the Ms-temperatures are lowered approximately 40°C/10kbar in all alloys. It is possible to consider from the results shown in **Fig. 1** and **Fig. 2** that the pressure dependence of Ms-temperature is unaffected by the kind and amount of alloying element.

The results of Ms-temperature measured under various pressures and those calculated by Predmore's equation[10]* concerning the free energy change for $\gamma \rightarrow \alpha'$ transformation are shown in **Table 2.** The calculated Ms-tempera-

* See appendix

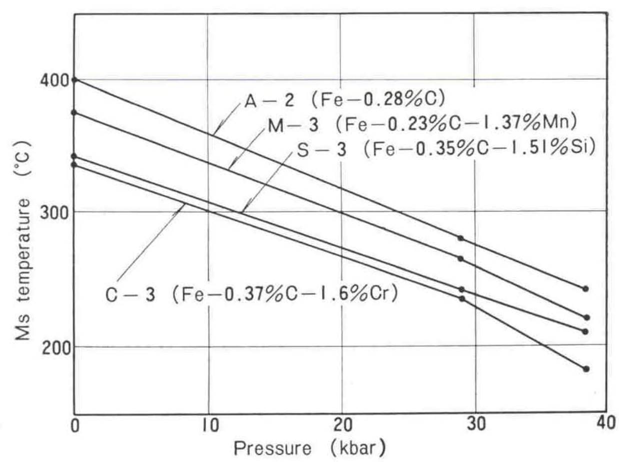

Fig. 2. Effect of pressure on Ms temperature for various Fe-C base alloys.

Table 2. Comparison of calculated and experimental Ms-temperatures (°C) under various perssures.

	1 atm		29 kbar		38.5kbar	
	cal	exp	cal	exp	cal	exp
A-2	430	400	320	280	280	240
A-4	375	340	270	240	230	210
C-1	395	350	295	245	255	190
C-2	390	340	270	245	230	185
C-3	380	335	260	235	230	180
M-1	430	400	330	290	295	240
M-3	425	385	325	275	290	235
M-3	405	375	305	265	270	220
S-1	425	360	325	275	290	230
S-2	425	360	325	275	290	220
S-3	375	340	270	240	230	210

cal=calculated by Predmore's equation[10], exp=experimental

Pressur / Sample	l atm	29kbar	38.5kbar	41kbar
A – 2	P	P	P+E	P+E+L
A – 4	P+L	P+L	L+E	L+E
M – 3	P	P	E	E
S – 3	P+L	P+L	L+E	L+E
C – 3	P+L	P+L	L+E	E

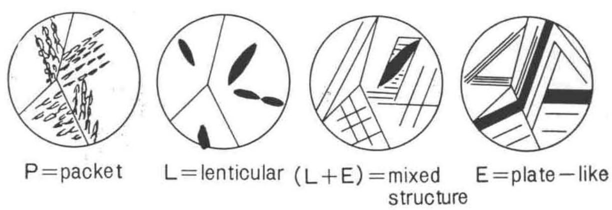

Fig. 3. Effect of pressure on free energy curve ($\Delta G^{\alpha' \rightarrow \gamma}_{(x, T, P)}$) of Fe-0.42%C alloy (A-4). Experimental Ms points were also plotted.

ture was determined on the basis of the thermodynamic consideration proposed by Kaufman et al.[20] Namely, Ms-temperature is defined as the one at which the difference in the free energy between γ and α phases is equal to the value of the driving force required for the initiation of the martensite transformation. Therefore, when the specimen is cooled to a temperature at which the equation (2) is satisfied, the martensitic transformation occur first.

$$\Delta G^{\gamma\to\alpha'}(x, T, P) + \Delta G_{v}^{\gamma\to\alpha'} \leqq 0 \qquad (2)$$

Here the value of driving force of 300cal/mol was used in this calculation. It is thought that this is a reasonable value, comparing with the value of 302cal/mol for the low alloy steels[10] and 290cal/mol for iron-carbon alloys obtained[6)21] thermodynamically. As an example of this calculation, the relationship between the change of the free energy with temperature and the measured Ms-temperature of Fe-0.42%C (A-4) is shown in **Fig. 3.** It can be seen in this figure that the driving force is about 300 cal/mol. Although the difference ranging from 30 to 60°C is recognized between measured and calculated Ms-temperature in the **Table 2,** the change of Ms-temperature by pressure can be predicted qualitatively from the calculation as described above.

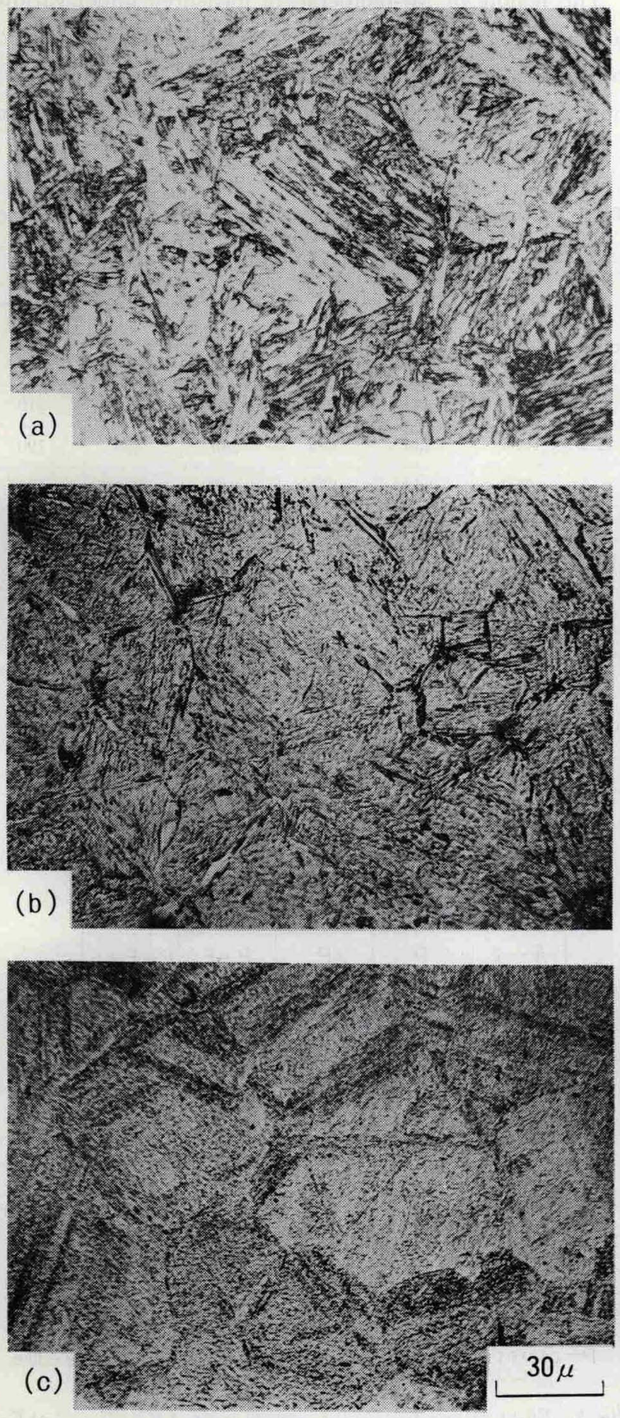

Photo. 1. Effect of pressure on martensite structure in Fe-0.26%Mn alloy (M-2).
(a) latm (b) 29kbar (c) 38.5kbar

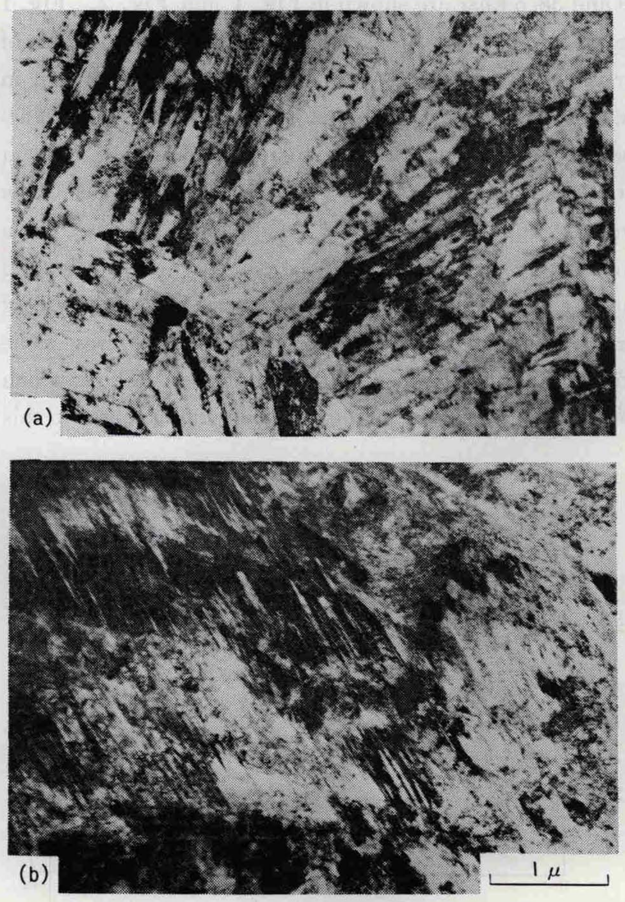

Photo. 2. Transmission electron micrographs of Fe-0.35%C-1.51%Si alloy (S-3).
(a) Lath martensite, latm (b) Internally twinned martensite, 29kbar