Hatch and Chipman,[7] and with calcium oxide activity data obtained from Darken's free energy diagram of the system CaO-SiO_2.[11] Values for a_{CaS} are calculated for slags of various basicities and sulphur contents, Table III and Fig. 8.

With emphasis on the ionic theory for liquid slags the expression $\frac{a_{CaO} \cdot S}{a_{CaS}} = \frac{a_{O^{2-}}}{\gamma_{S^{2-}}}$ is suggested as a measure for the sulphur capacity of the slag.

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Technical Note

Effect of Hardness on Temper Brittleness

by D. C. Buffum and L. D. Jaffe

QUANTITATIVE measurements of the temper brittleness of steel are made by comparing the difference between embrittled and unembrittled specimens in the temperature of transition from ductile to brittle fracture. Since hardness affects the transition temperature, a study of the combined effects of hardness and temper brittleness appeared desirable.

In this investigation a commercial SAE 3140 steel, which has been reported on previously in temper brittleness studies,* was used. Blanks from this steel were austenitized for 1 hr at 900°C and water quenched. The blanks were then divided into six groups and further heat treated as follows: Group 1—tempered at 675°C for 4 hr and water quenched; Groups 2, 3, 4, and 5—tempered at 675°, 650°, 625°, and 600°C respectively for 1 hr and water quenched; and Group 6—tempered at 500°C for ½ hr and water quenched.

Each of these groups was divided into two parts; one part was tested without further heat treatment, and the other was embrittled for 48 hr at 500°C and water quenched. Tempering treatments between 500° and 600°C were avoided because of the rapid embrittlement occurring in that range for this steel.

The heat-treated blanks were machined into standard V-notched Charpy bars. Each group was tested over a range of temperatures on a 217 ft-lb Charpy machine.

The energies necessary to fracture the bars and the percentage fibrous fracture of each bar were recorded. The transition temperatures were obtained from a plot of the percentage fibrous fracture as a function of testing temperature. They were taken as the lowest point on these curves at which the fracture was 100 pct fibrous. The transition temperatures for both embrittled and unembrittled specimens are presented in Fig. 1 as function of the hardness. It will be noticed in this figure that the point for the unembrittled condition at 21 Rockwell C is out of line. These specimens were tempered for 4 hr at 675°C and this point indicated that under isothermal conditions at this temperature, as is well known, embrittlement may develop fast enough to more than offset the effects of softening.

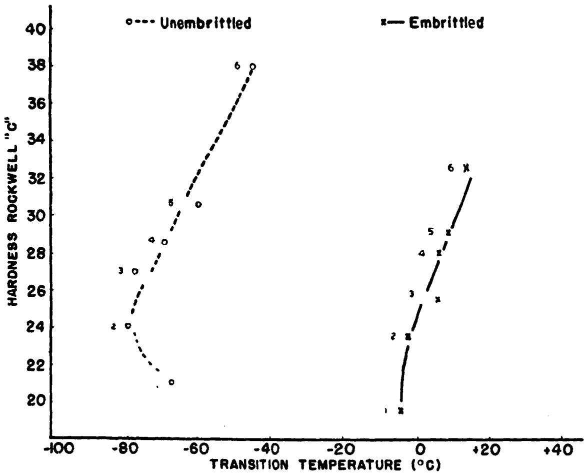

Fig. 1—Transition temperature as a function of hardness. Numbers indicate heat treatment groups.

From this data, it was concluded that the difference between transition temperatures for the embrittled and unembrittled conditions at any given hardness, within the range of Rockwell C 24½ to 32½, is constant.

It is also concluded that, within the hardness range studied, the transition temperatures for embrittled and unembrittled specimens rise in a parallel fashion with an increase in hardness.

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