Many factors are involved which are beyond the scope of this paper to discuss and therefore no attempt will be made to assess the relative merits of the suspended roof and the sprung arch for reverberatory smelting furnaces. The important fact is that with the use of either the suspended basic roof or "slurry patching" of the sprung silica arch, smelter operators now have a means of prolonging roof life almost indefinitely. This has made possible greatly increased furnace tonnages and has at the same time resulted in lower furnace repair costs.

Summary

The development of furnace practice at Noranda has been reviewed and present operation has been described in considerable detail. Under present conditions the emphasis is no longer on maximum tonnage but on increased efficiency and in recent years the fuel ratio has been improved, modern waste heat boilers have been installed, and a considerable metal recovery has been effected by treating the furnace gases in a Cottrell plant. Canadian and American furnace practices have been compared and some explanation given for differences in principles and methods.

Acknowledgments

The history of the development of reverberatory furnace practice at Noranda would not be complete without paying tribute to Mr. W. B. Boggs, Smelter Superintendent from 1928 to 1948, whose bold pioneering was responsible for the progress of which some record has been made here. Acknowledgment is made of the permission granted by the management of Noranda Mines Limited to publish the information and data contained in this paper. The author's thanks are due to Mr. L. K. Shibley, Assistant Smelter Superintendent, and Mr. G. C. McKerrow, Metallurgist, for their assistance in the preparation of the paper.

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Technical Note

A Correction to "The Sigma Phase in Binary Alloys"

by Peter Greenfield and Paul A. Beck

RECENT work by J. Darby, Jr. in this laboratory has shown that the reported¹ vanadium-rich limit of the σ phase in the Co-V system at 1200°C is in error. The appearance of a second phase in σ actually is restricted to alloys containing over 68 atomic pct V. The error in the original value is due apparently to a reaction that takes place along the numerous cracks in the σ specimens between the alloy and the impurities present in the He + 8 pct H atmosphere in the annealing furnace. Such a reaction and the consequent appearance of a second phase can be suppressed if the alloys are sealed under vacuum in Vycor tubing.

The new value of 68 atomic pct V for the vanadium-rich limit of the σ phase in the Co-V system effects slightly the σ compositions calculated from average values of N_v and N_e for various σ phases.¹ The standard deviation between experimental mean compositions and those calculated from the assumption that σ is characterized by a constant number of $3d + 4s$ electrons per atom (N_e), is slightly reduced from 9.1 to 8.8 pct. The maximum divergence for the V-Mn σ phase is reduced from 15.5 to 14 atomic pct.

The standard deviation calculated from constant electron vacancy numbers given by

$$N_v = 4.66(\text{Mo} + \text{Cr} + \text{V}) + 3.2(\text{Mn}) + 2.2(\text{Fe}) + 1.71(\text{Co}) + 1.6(\text{Ni})$$

is now greatly reduced, as the maximum divergence for this correlation previously occurred in the V-Co system. This maximum divergence is reduced from 7.6 to 2.3 pct, and the standard deviation for all σ phases is reduced from 4.1 to only 2.9 pct.

The correlation for electron vacancy numbers given by

$$\begin{aligned} N_v = & 5.66 (\text{V when with Ni or Co}) + \\ & 4.88 (\text{V when with Mn or Fe}) \\ & + 4.66 (\text{Cr} + \text{Mn}) + 3.3 (\text{Mn}) + \\ & 2.66 (\text{Fe}) + 1.71 (\text{Co}) + 0.61 (\text{Ni}) \end{aligned}$$

is made slightly worse, and the standard deviation increases from 2.8 to 3.9 pct. These changes, however, do not affect the conclusions of the paper.¹ The deviation between calculated and experimental σ compositions is much less for either one of the electron vacancy correlations than for the correlation with the number of $3d + 4s$ electrons.

¹ P. Greenfield and P. A. Beck: *Trans. AIME* (1954) **200**, p. 253; *JOURNAL OF METALS* (February 1954).

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