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Report. No. 344/64

DISCUSSION: "Compressive, Impact and Other Mechanical Properties of Nickel and Some of its High Strength Corrosion Resisting Alloys", C. F. Catlin and A. A. Mudge, A.S.T.M. Preprint #50.

When studying metals for purposes of comparison and of engineering design, the necessity of making tests at various velocities of impact was first pointed out by Sir Robert Hadfield in 1906, and of recent years Mr. H. C. Mann has established an understandable basis for such work. He used tension impact specimens. Watertown Arsenal has not made variable velocity impact tests of high nickel alloys. However, with reference to K Monel and even B Monel, limited tests of the nature described by H. C. Mann in Proceedings A.S.T.M., 1935, have shown that the energy value obtained from the load elongation curve (static test) is more than the energy value obtained in the impact (dynamic) test when the velocity of impact was about 28 ft./sec. This indicates a falling off of impact energy at some velocity of impact less than 28 ft./sec. Direct observations of the transition velocity should therefor be made.

On page 6 of the preprint, it is mentioned that the tension impact test permitted calculation of ultimate fracture strength in ft. lbs. per sq. in. In the 1937

Proceedings A.S.T.M., H. C. Mann showed that the impact energy for the steels tested is dependent upon the <u>volume</u> of material participating in the absorption of energy. The tension impact specimen within reasonable limits of size and with square shoulders permits the accurate measurement of that volume. It follows that with reference to the general type of specimen shown on the top of Figure 1, if the length were halved and the cross-sectional area doubled, the same impact value would be obtained because the volume is the same. For the <u>same</u> length, the impact value will change proportionally as the cross-sectional area is changed because under this limitation the volume changes proportionally as the cross-sectional area.

In Ordnance, the transverse properties of metals are important observations, and consequently longitudinal and transverse tests are made especially when checking a new material. The following shows a comparison of R Monel in the transverse and longitudinal directions, test specimens being taken at 50% radius of a 4 x 4 billet.

% S	Direction	Yield Strength % Set 0.00	0.05	0.20	Tensile Strength	Elon.	R.A.	Impact* Tension Notch ft.lbs.
0.027	Long.	29500	33400	35100	81700	45.5	69.5	67
	Trans.	28500	33400	35700	80500	40.0	51.0	48
0.037	Long.	28500	34500	36000	72300	45.0	71.5	59
	Trans.	29000	34300	36100	70500	33.0	38.0	36

* Spec. described in Federal Spec. [illegible]-151a

It is to be observed that the transverse properties of this "free machining" quality of monel have held up remarkably well for these size billets with these contents of sulphur. Of particular note are the values for elongation and reduction of area and impact, and how the effect on the transverse values of these properties increases as the sulphur content increases.

Peter R. Kosting