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A New High Performance, Cost Effective, Carburizing Grade Alloy Steel

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A NEW CARBURIZING GRADE ALLOY STEEL has been developed. This alloy utilizes nickel, chromium, and vanadium to provide a steel with high levels of hardenability, toughness, and fatigue resistance. Its nominal composition is:

C	Mn	Si	Ni	Cr	V
0.19	0.55	0.20	1.80	0.60	0.12

This paper describes the properties of this Ni-Cr-V alloy determined in laboratory tests and commercial application evaluations and compares these properties to those of other standard high performance carburizing grades.

LABORATORY EXPERIMENTS

COMPOSITIONS - Several standard carburizing grade alloys were tested for comparison with the Ni-Cr-V material. The compositions of these materials are listed in Table I. The nickel content of the alloys ranged from 0.18% (i.e., residual level) to 3.65%.

PROCESSING - One group of alloys was melted as 70 pound air-induction-melted heats. These heats were forged at 2150°F to 1-1/4-inch square bars. Hardenability specimens were sectioned from these bars. Three-inch lengths from these bars were subsequently upset forged at 2000°F to 1/2-inch thick sections to simulate a commercial forging operation. Blanks for impact specimens were sectioned from these upset sections.

A second group of alloys was melted as 250 pound air-induction-melted heats. These heats were forged to 1-3/4-inch diameter round bars. Hardenability and impact specimens were sectioned from these bars. Component tests were also conducted with this group of heats; these tests are described later.

HARDENABILITY - The Jominy hardenability data for these laboratory heats are illustrated in Figures 1 and 2. The Jominy bars were normalized at 1700°F and end quenched from 1700°F

ABSTRACT

A 1.8 Ni-0.60 Cr-0.12 V alloy steel has been developed for use in carburizing applications. Hardenability, strength, toughness, and fatigue tests have been conducted on this material. Comparisons were made with the properties of several standard nickel alloy steels including 4620, 4320, 3310, and 4815 which show that the Ni-Cr-V alloy performs at least as well as the 1.8% Ni grades (4620, 4320) and approaches, and in some instances equals or exceeds, the 3.5% Ni grades (3310, 4815). The Ni-Cr-V alloy can provide a cost effective substitute for these more costly high nickel grades.

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