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PRODUCTION OF A LOW-BORON HEAT OF HASTELLOY N

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METALS AND CERAMICS DIVISION

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Current mechanisms for the irradiation embrittlement of structural alloys at elevated temperature are generally associated with the production of helium by (n,α) reactions. In most reactor environments the helium is generated from the transmutation of ^{10}B. Boron is generally present in nickel-base alloys at concentrations in the range of 5 to 80 ppm by weight. These concentrations are above those that have been observed to produce deleterious quantities of helium in stainless steels.

The Stellite Division of Union Carbide has melted a 75-lb heat of Hastelloy N, using a practice designed to produce low residuals of boron, oxygen, nitrogen, hydrogen, silicon, and sulfur. This vacuum-induction heat, designated heat 65-552, was melted using an alumina crucible. Since no deliberate additions of boron were made in the melting practice, analysis of the final heat and the raw materials should lead to discovery of the source of boron in the alloy. These data are given in Table 1. The concentration of boron is much less than the normal 5 to 80 ppm. It is apparent that most of the boron was not introduced into the alloy from the raw materials listed in Table 1. Approximately 84% of the boron in the ingot was introduced by some other means. There are perhaps several other sources but a prime suspect is the alumina crucible. Future work should help define further the probable sources of boron.

It has been demonstrated that a heat of Hastelloy N can be produced in 50 to 75-lb ingot sizes that contain substantially lower quantities of boron than is normally found in these grades of material. It therefore seems probable that larger ingots in the range of 10,000 lb can also be produced which could offer improved properties for reactor application at elevated temperatures.

Table 1. Boron Analyses

Material	Boron Concentration (ppm by weight)	Approximate Boron Contribution to Alloy (ppm by weight)
Hastelloy N	0.90	
Total Raw Materials in Alloy	0.14	0.144
Electrolytic nickel	0.08	0.057
Molybdenum rondels	0.25	0.042
Electrolytic chromium	0.06	0.005
Armco Iron	0.45	0.019
Electrolytic manganese	0.30	0.002
Aluminum shot	3.50	0.016
Nickel-magnesium	0.08	0.0002
Graphite	4.50	0.003

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