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ABSTRACT

The upper resistive critical field for a $Nb_3(Al_{0.9}Ge_{0.1})$ compound, prepared by hot pressing, was found to be in excess of 200 kilogauss at 4.2°K.

Recently Matthias, et al.[1] have discovered that the addition of Ge to Nb_3Al produces a compound more nearly approaching the ideal stoichiometry. The compound $Nb_3(Al_{0.8}Ge_{0.2})$ had a T_c above 20°K. Other investigators have reported high critical fields for compounds having the A15 structure and high T_c. Critical fields in excess of 200 kilogauss have been reported for Nb_3Sn[2] and V_3Ga.[3] Since Matthias, et al. did not report any critical field data, we have made several $Nb_3(Al,Ge)$ alloys and tested them in high magnetic fields.

Elemental powders of Nb, Al, and Ge were mixed in various proportions. They were sintered at a low pressure in a hot press for 10 min at 1150°C. They were then pressed at 500 psi for 5 min at 1150°C, and at the same pressure for 15 min at 1650°C. Dense specimens having dimensions about 0.25×0.25×1.0 cm were obtained. The critical temperatures, detected by the change in inductance of a coil surrounding the sample, were in the neighborhood of 18°K for all samples. For the high field measurements the specimens were reduced to about 10^{-2} cm^2 in cross section; currents ranged from 8 to 20 amperes. The upper resistive critical field, H_r, was measured at 4.2°K by a pulse technique.[4] The field was perpendicular to the current.

The existence of the A15 structure was confirmed by x-ray diffraction, which also revealed the presence of Nb_2Al (σ-tetragonal) and possibly Nb. Microscopic examination also showed that the specimens were multiphase materials. The current density was estimated from the microstructure.

Figure 1 shows the J_c vs H data. The line corresponds to the field at which normal resistance was completely restored in the specimen having

a nominal composition $Nb(Al_{0.9}Ge_{0.1})$. This composition exhibited the highest fields of the samples tested.

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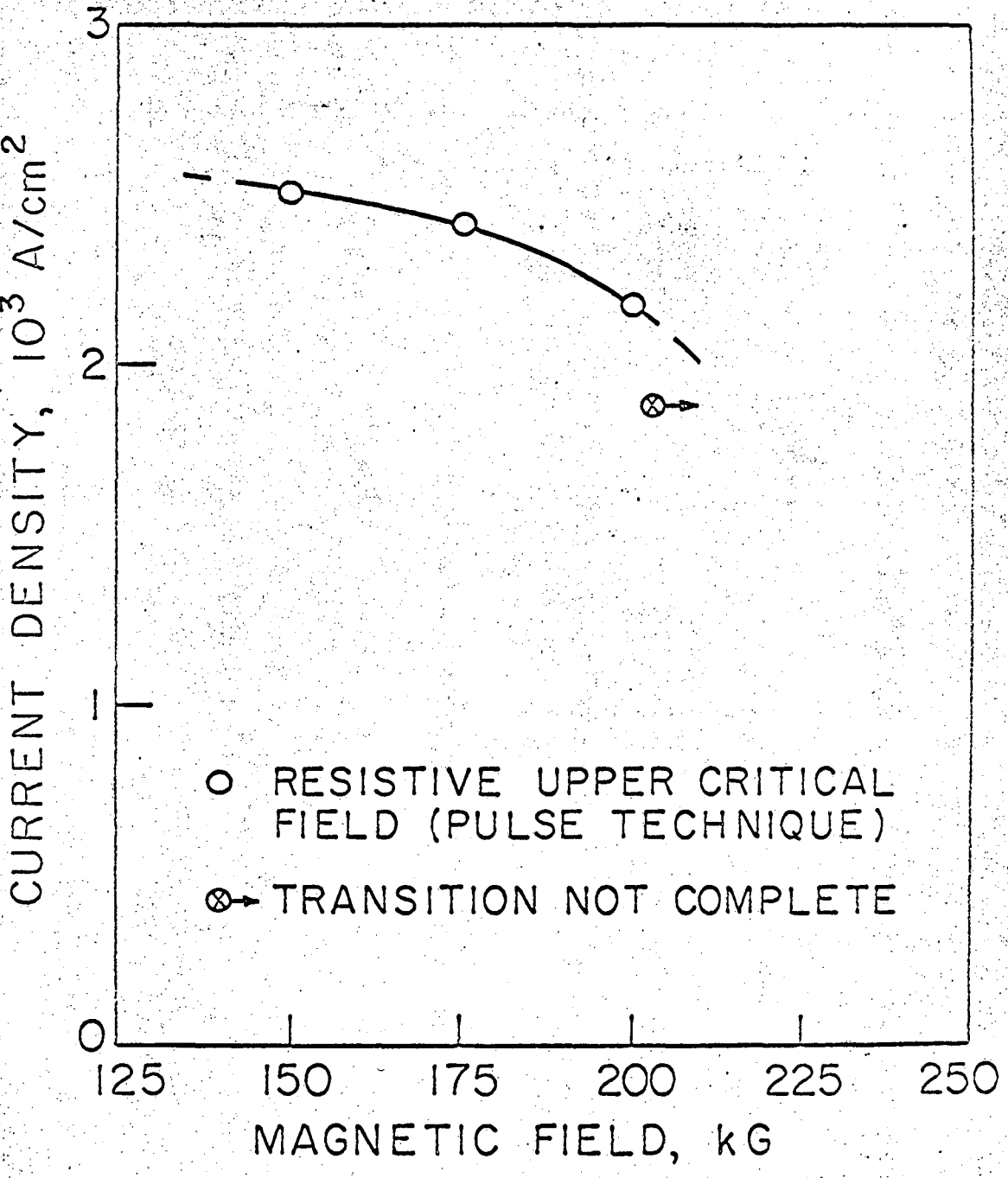

Fig. 1 The upper resistive critical field vs current density, measured at 4.2°K, for a hot pressed material having a nominal composition of $Nb_3(Al_{0.9}Ge_{0.1})$.