Effect of high pressures and temperatures on the superconducting properties of the compound Nb_3Ge with *A*-15 structure

L. F. Vereshchagin, E. M. Savitskiĭ, V. V. Evdokimova, V. I. Novokshenov, and V. G. Petrenko

Institute of High Pressure Physics and Institute of Metallurgy of the USSR Academy of Sciences

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We investigated the influence of high pressures and temperatures (up to 90 kbar and 2000°C) on the critical temperature of the compound Nb_3Ge. Values $T_c = 19.7$°K were obtained. The temperature of the start of the superconducting transition reached 22.2°K.

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We have attempted to synthesize and process the compound Nb_3Ge with A-15 structure under the influence of high pressures and temperatures in the intervals 50—90 kbar and 1200—2000 °C. The compound was synthesized from a mixture of powders of the original elements. The material treated in the high-pressure chamber[1] was an alloy of niobium with 25 at.% germanium, obtained by induction melting in the suspended state, to which pure powdered germanium was added after grinding. The superconducting transition temperature was measured by an inductive method.

In all cases in which we succeeded in synthesizing the Nb_3Ge compound, its T_c was never lower than 11 °K, i. e., no "classical" Nb_3Ge with T_c values 6 – 7 °K [2] was observed in the case of fusion under high pressure. The maximum superconducting transition temperatures (19.4 and 19.1 °K) were possessed by samples synthesized at 70 kbar, 1400 °C, 5 min and at 70 kbar, 2000 °C, 1 min, respectively. Processing an alloy of niobium with 25 at.% germanium to which the second component was added led to an increase of T_c, from 6.1 °K for the initial Nb_3Ge compound to 19.5 – 19.7 °K for samples subjected to pressures 70 – 90 kbar at 2000 °C for 15 – 30 sec. The temperature of the start of the superconducting transition in these samples was 22.0 – 22.3 °K. According to x-ray local microanalysis data, the composition of the Nb_3Ge compound having these high values of T_c is quite close to stoichiometric. The lattice parameter of the β phase (of the Nb_3Ge compound) was 5.135 – 5.140 Å (±0.005 Å) in both series of experiments.

We note in conclusion that the attained superconducting transition temperatures are the highest known for binary superconducting compounds in the bulky state.

[1] L. F. Vereshchagin, V. V. Evdokimova, V. I. Novokshenov, *et al.*, in: Struktura i svoĭstva sverkhprovodyashchikh materialov (Structure and Properties of Superconducting Materials), Nauka, 1974, p. 84.

[2]V. M. Pan, V. I. Latusheva, and E. A. Shishkin, in: Metallovedenie, fiziko-khimiya, i metallofizika sverkhprovodnikov (Metallurgy, Physico-chemistry, and Metal Physics of Superconductors), Nauka, 1967, p. 157.