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Deformation behaviour and critical temperature of NbTi superconductor processed by cold rolling with a pulsed current

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NbTi superconductors are traditionally produced by a process, which comprises many stages. It is characterized by large true strain, as well as high energy, labor and time consumption.
A combining severe plastic deformation by rolling (SPDR) with pulse current for various kinds of materials leads to a decrease in flow stresses and microstructure refinement, as well as to improvement of the deformability, microhardness, and other mechanical characteristics of the material. It is assumed that these effects are due to the interaction of conduction electrons with lattice defects during material deformation.
The aim of this study is to investigate specific features of SPDR with pulse current in NbTi superconductive wire.
The influence of SPDR and pulse current combined effect on composite, which includes electrical and thermal Cu-stabilizer, Nb-diffusion barrier and Nb–47wt.%Ti core, has been investigated. Specimens were rods by size of ∅7 ×120 mm. SPDR with pulse current was carried out using a setup that included a rolling mill with 1 to 7 mm rolls, a pulse current generator, and an oscillograph. The rolling was performed at room temperature without heating. The current density was j =100 A/mm2.
It was shown that pulse current during the SPDR enhances the strength and microhardness and retains the superconductivity effect. It was found that tension with pulse current displays the electroplastic effect in the NbTi superconductor.

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