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Investigation of epoxy impregnated Nb₃Sn superconducting coil for high field applications

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In order to developing the nuclear magnetic resonance (NMR) superconducting magnet and other applications, a series of high field magnet manufacture technologies are researching in our institute, IEE CAS. The Nb₃Sn superconductor is indispensable for the 500 MHz and above NMR magnet. In this paper, a dynamic vacuum pressure impregnation (VPI) process of Nb₃Sn coil on the basis of Darcy's law of fluid mechanics in porous media are modeled and analyzed. The influence of several VPI parameters on the impregnation results is studied. Also, the research process of high field Nb₃Sn superconducting coil technology is presented. The cryogenic test results show that the critical current of the Nb₃Sn coil reaches 400 A, and central magnetic self-field is 6.67 T. Under the 13 T back magnetic field, the Nb₃Sn coil has the critical current of 130 A. The central magnetic field increases to 15.25 T. The critical property of the Nb₃Sn coil reaches 92 percent of that of short sample. The epoxy impregnated Nb₃Sn coil fabrication technology was also introduced in the NbTi/Nb₃Sn split magnet system.

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