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Wed-Af-Or14-04: Wire and Cable Characterization of Nb3Sn Conductor with High Heat Capacity

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Accelerator magnets made of state-of-the-art Nb3Sn strands unveil relatively long training. This could be due to the low stability of high-Jc Nb3Sn wires to flux jumping provoked by mechanical perturbations in the magnet coils and/or by epoxy cracking. Conductor stability to flux jumps can be increased by reducing the superconductor filaments size while maintaining low resistivity of the copper matrix, and by increasing the composite specific heat cp, which increases the conductor enthalpy margin. A considerable increase in stability of Nb3Sn multifilamentary composite wires made with the Powder-in-Tube process with gadolinium oxide Gd2O3 and Cu powders in Cu tubes replacing a few of the Nb tubes had been demonstrated previously. Within a collaboration with Bruker EAS and Bruker OST, FNAL developed a high-Jc Rod Restack Process (RRP) composite wire with 36 superconducting subelements, 24 high-cp Cu tubes with Gd2O3 and Cu powders over 61 total hexagonal subelements. To study the response of this new billet to plastic deformation, round wires were flat-rolled to various deformation values. This method imparts a homogeneous deformation along a wire. Then Rutherford cable was fabricated to study the effect of uneven and localized plastic deformation on the wire. Critical current Ic, average critical current density JA, minimal stability current IS , minimal quench energy, MQE, and matrix RRR were measured for flat-rolled and extracted strands, and compared with round wire data.

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