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Tue-Mo-Po2.13-09 [116]: Phase structure and superconducting properties of RHQT Nb3Al wires fabricated by static and dynamic rapid heating

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This work compared the phase structure and superconducting properties of RHQT Nb3Al wires fabricated by static and reel to reel (R2R) rapidly heating and quenching conditions. The time for static and dynamic heating of the wire is 0.8s and 0.4s. Rapid heating current (IRHQ) of 67A˜69A for static RHQ and 120˜122A for R2R dynamic RHQ can fabricated ductile precursor wires and obtain single phase Nb3Al wires after low temperature transformation process. The Tc-onset of RHQT Nb3Al wires are about 16.8 K under various heating conditions and Tc-mid changed between 16.6K and 12K depending on the heating current. Compared to wide superconducting transition of 3K for the static RHQT samples, R2R RHQT Nb3Al wires show much smaller ΔTc of about 1K, indicating significant improvement of composition homogenous in the formed A15 phase. The critical current density (Jc) of RHQT Nb3Al fabricated by R2R RHQ is stable of 4.0˜4.5×105A/cm2@4.2K, 7T which is almost independent of the heating current, meanwhile, static RHQ wires show Jc in the range 5×104A/cm2˜1.1×105A/cm2@4.2K, 7T. For the samples fabricated under smaller current of static RHQ (64A˜65A) and higher current of dynamic RHQ (123A˜124A), Nb2Al impurity phase was generated in the RHQT Nb3Al wires. These wires exhibit much lower Jc performance of 2×103A/cm2 for static RHQ and 5×104A/cm for R2R dynamic RHQ samples @4.2K, 7T. The main pinning mechanism of Nb3Al superconducting wires was grain boundary pinning, as deduced from the fitting of flux pinning force versus applied field curves.

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