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An Approach to Development of the HTS Magnet for SMES at JINR

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Particle accelerator complex NICA comprises Booster and Nuclotron accelerators which dipole magnets operate at pulse mode in opposite phase with a period of about 4 seconds. Summary energy of Booster and Nuclotron dipoles will vary from 1 to 2.6 MJ during the period. NICA power supply system can be significantly improved by Superconducting Magnetic Energy Storage (SMES) application that will help to move the energy back and force between Booster and Nuclotron. The useful energy at this SMES must be about 1.6 MJ so the maximum total SMES energy should be 3-5 MJ. SMES with this energy should have several Tesla magnetic fields to keep a reasonable size. SMES operating current can be not less than Booster and Nuclotron dipoles currents so it might be 10-12 kA. It is better to make such a SMES magnet from an HTS cable for the sake of stability at 6-7 T 4 s pulse mode. SMES magnet is planned to be wound as a short solenoid (Brooks coil) of cables optimized for several coaxial sections. HTS cables with a helical structure similar to well-known CORC cables are under the development at JINR. The HTS cabling technology is based on the same principle as nuclotron type cable manufacturing technology. HTS tapes, cables and magnets experimental study and testing methods are being developed on the base of the existing test facility at LHEP. JINR is also going to develop high field fast cycling dipole magnets for accelerators of HTS cables of the same type.

Keywords: supeconducting magnetic energy storage, high temperature superconductor, superconducting cable, fast cycling magnets