A Collaborative Research to Develop a 6 T 230 mm Room-temperature Bore High Temperature Superconductor MRI Magnet

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Abstract – **Supported by the Korean government, a 4-year collaborative research led by SuperGenics, Co., Ltd., was embarked in September 2020 to develop a 6-tesla high-temperature superconductor (HTS) MRI magnet. The participating institutes include Korea Electrotechnology Research Institute, Seoul National University, Changwon National University, Korea University, Kunsan National University and Korea Maritime and Ocean University. Due to a limited budget, the magnet room temperature bore size was set to be 230 mm or less. Yet, we are expecting the magnet, once successfully completed, to play an important role as a pilot magnet to fulfill our ultimate goal to develop a next-generation ultra-high field (>7 T) all-HTS whole-body (>800 mm) MRI magnet. Key design philosophies include: (1) use of the "metal insulation" to mitigate the so-called "no-insulation" drawbacks; (2) liquid-helium-free by use of conduction cooling at 20 K. Though somehow controversial, the higher magnetic field MRI enables the clearer image acquisition with the shorter image acquisition time. Recently a 11.7 T 900 mm low-temperature superconductor MRI magnet (ISEULT) is about to be completed but its size, weight and cost may not best-fit into clinical use. In addition, the operating cost of MRI in the medical field has been already increasing significantly due to supply instability of helium. The HTS MRI magnet may be an alternative solution to those challenges. This paper reports specific aims of the project, the initial design of the magnet, roles of the participating institutes and potential pitfalls and challenges.**

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