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M2Po2C-01: Development of a new S-shaped Superconducting Hexapole for compact ECRIS

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With the increasing demand of accelerators for high-energy particles, it is necessary to develop ECRIS (electron cyclotron resonance ion source) with compact structure, small volume, and high energy. ECRIS, which generates highly charged particles, is an essential component of heavy ion accelerators and heavy ion therapy equipment. A new S-shaped hexapole structure was proposed in 2016, which can greatly reduce the size of ECRIS magnet [1-2]. The S-shaped hexapole can simplify the distribution of interacting Lorentz forces in ECRIS superconducting magnet and help to increase the required axial field in ECRIS. However, the manufacture of S-shaped coils is very difficult, and it is also difficult to apply pre-tightening force at the end of the S-shaped coil. There is no reference on the manufacture of the new type superconducting hexapole. Two designs of the S-shaped coil and their special skeleton will be presented in this study. Based on the two designs, two coils using NbTi wire were developed in this study, including a test coil and an S-shaped hexapole prototype for 14.5 GHz ECRIS. The test coil is designed with a skeleton with slots at both ends to realize the winding of the S-shaped coil. The S-type hexapole test coil is wound with only one cable, realizing continuous and uninterrupted winding from inside to outside and from outside to inside. The prototype coil uses the skeleton slotted at one end to further reduce the size of the S-shaped hexapole. Both the fabrication processes and the cold test results will be presented in this study.

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