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Development of Analyzing Capability of React and Wind Process based on Strand Trace and Inter-Strand Resistance Measurement System for Cable-In-Conduit Conductor

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ITER project has been running in decades and has started after complications. While it is now under construction, design activity for new fusion device called "DEMO"has already taken place, in which the superconducting magnet system will be much larger than that of ITER. In the present project, the magnets are made of Nb3Sn superconducting material, hence heat treatment is needed to generate Nb3Sn intermetallic compound. In terms of fabrication process of large scale magnets, the heat treatment is applied after making coil shape, which is called "Wind and React"process because the Nb3Sn is sensitive to bending strain after heat treatment. Since we need to construct the huge electric heating furnace, introducing the process is one of the biggest problem with respect to the cost and high requirements of its dimensional tolerance for making large scale magnets.
In terms of designing DEMO magnets which are much larger scale than that of ITER magnets, more simple process, winding after heat treatment of conductor has been discussing in recent years, so called "React and Wind"process. Although it looks reasonable to make huge magnets, there is no research to evaluate the expected strains when we choose the conventional Cable-In-Conduit (CIC) conductors. To clear the applicability of the conventional conductors to the React and Wind process, we have been developing direct measurement system of all strand traces and inter-strand contact resistance as well as strain analyzing tools based on structural mechanics and complicated electrical network calculation. We will report the progress of proposing system at the upcoming conference.

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