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## Mechanical stress simulation of REBCO tapes using particle methods

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Performances of ultra-high field superconducting magnets have been improving. On 2017, a world-record high magnetic field of 45.5 T was generated with insert no-insulation (NI) Rare-Earth Barium Copper Oxide (REBCO) pancake coils (14.4 T), called "LBC3", and an outsert resistive magnet (31.1 T). After 45.5-T generation, the insert NI REBCO pancake coils were quenched, and plastic deformations of REBCO tapes were observed. Since the Hastelloy substrate of REBCO tapes are stiff, whose yield point is approximately 1 GPa, REBCO tapes have great mechanical properties as well as high critical current density and critical magnetic field. NI REBCO pancake coils showed their potential to generate an ultra-high magnetic field. However, after experiment, REBCO tapes were damaged in a several cases, e.g. the LBC3 and the MIT 1.3-GHz NMR insert magnet. The critical current properties of damaged REBCO tape were degraded. Therefore, to develop ultra-high magnetic field, it is necessary to clarify the mechanical phenomenon of both REBCO tapes and magnets.

So far, some journal papers on mechanical simulation on REBCO magnets have been published. In these papers, the finite element method (FEM) was employed as a mechanical simulation. However, the FEM cannot accurately simulate plastic deformations. Hence, in the presentation, we will model REBCO tapes with a particle method, which are able to represent plastic deformation of material, for mechanical simulation. We will show the simulated mechanical behaviors of REBCO tapes under large electromagnetic force.

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