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FastGrid

COST EFFECTIVE FCL USING ADVANCED SUPERCONDUCTING TAPES FOR FUTURE HVDC GRIDS

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NEWS

Bringing Renewables to the Power Grid

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Pascal Tixador, project's coordinator of FASTGRID, has been interviewed by Sandrine Ceurstemont for an article on applications of REBCO tapes and Superconducting Fault Current Limiters for Horizon Magazine - the EU research and innovation magazine.

To read the full article, please use the link here.

FOCUS ON

The FASTGRID Superconducting Fault Current Limiter

One of the most promising objectives of FASTGRID is the production of state of the art High-Temperature Superconductors specially designed for current limitation with high performances at an affordable cost. To test the conductor in real conditions, a Superconducting Fault Current Limiter (SFCL) module will be made and tested.

The superconducting fault current limiter is a device able to protect the electrical grid. During a fault on the network, the current is raising in a few milliseconds and is likely to destroy the grids' systems (see Figure 1). A breaker will switch off the circuit and clear the current but only after 30 to 50 ms, more performant breakers can be designed but their price and their complexity are directly correlated to their rapidity to and the value of current to clear.

By adding a fault current limiter in the network, it is possible to lower the level of current during a fault (see Figure 1). As soon as the current increases, the superconducting material will lose its superconducting state and start to dissipate introducing an electrical resistance into the grid. This phenomenon is completely physical and adaptable to all sorts of applications.

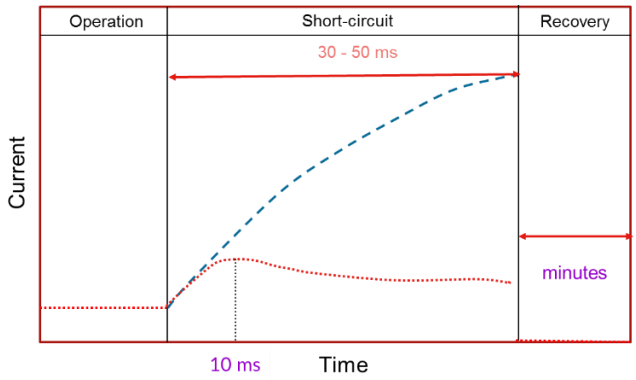

Figure 1: Current versus time in a faulty line with or without a SFCL.

To achieve this function, FASTGRID partners have teamed up to design an innovative SFCL (specification in the table on the right). The 50 kV SFCL working at 65 K will need only 680 meters of 12 mm width upgraded superconducting tape provided by THEVA. It is six times less than the quantity needed for a similar SFCL before our FASTGRID project. Consequently, the FASTGRID SFCL will be more compact and less expensive than the previous systems. This system could be duplicated and seven of such module can be connected in series to build a full 320 kV SFCL desirable for HVDC transmission grid.

Rated DC Voltage	50 kV
Operating temperature	65 K
Operating absolute pressure	2.5 bar
Pancake voltage	5 kV
Number of pancakes	10
Operating current	1.2 kA
Current after limitation	2-2.5 kA
Length of conductor needed **before FASTGRID**	2000 m
Length of conductor needed **after FASTGRID**	680 m

The production of the upgraded conductor is scheduled for the last quarter of 2018 for an assembly in early 2019. Then, this 50 kV demonstrator will be tested in 2019.

Read More about FASTGRID objectives

For more information: http://www.supergrid-institute.com/

EVENTS

Review Meeting in Brussels

Work packages' leaders and coordinator of FASTGRID met with the EC Project Officer, Mr. Gieb Martin and the External Expert, Ms. Ewa Jedryka (IFPAN), in Brussels in February for the first Review Meeting of the FASTGRID project.

This one-day meeting, holding at the end of the first reporting period, was meant to evaluate the project's progress and to review the technical report. Different from usual technical meeting and required by the European Commission, the purpose of this meeting was to estimate whether the project is on track, behind or ahead of schedule.

This meeting was the opportunity to meet face to face with Mr. Gieb and to point out five innovations that flow from the project.

1. REBCO conductor with improved properties for high voltage SCFCL

The present RECBO conductors withstand a moderate electric field under limitation. The innovation consists of a REBCO tape bonded to a dedicated shunt to support much higher electrical fields under limitation (factor larger than 2) while the conductor withstands any type of fault, especially low prospective currents.

2. Current Flow Diverter (CFD) implementation for more robust REBCO tapes

The present RECBO conductors show rather low Normal Zone Propagation Velocities. This induces high risks of destructive hot spots especially for fault currents near the critical current and an overdesign of the REBCO conductor. The CFD innovation is based on a new REBCO tape architecture with the introduction of an interfacial layer to significantly increase (factor 10) of the NZPV. This makes the REBCO tape much more robust and reliable while its design is notably simplified.

3. REBCO tapes on sapphire substrate

Present REBCO tapes use metallic substrates, which lead moderate electric fields under limitation and low normal zone propagation velocity (NZPV). The use of sapphire substrates fully changes the performances and behaviour. It leads to extremely high electric fields, at least one order of magnitude compared to the FASTGRID objectives with a metallic substrate. Sapphire substrate tapes are a breakthrough for SCFCL but need to be implemented at long lengths at an acceptable cost with an industrial process

4. **REBCO tapes on sapphire substrate with Current Flow Diverter (CFD) implementation**

Even if sapphire substrate tapes already show very high normal zone propagation velocity, the implementation of Current Flow Diverter still enhances it. This makes the REBCO sapphire tape still much more robust and reliable while its design is notably simplified.

5. **HVDC SCFCL Demonstrator using REBCO tapes**

Up to now superconducting fault current limiters have been developed and built for AC power systems. In HVDC systems they are promising to overcome the challenge of switching DC currents. This project will be the first in Europe that demonstrates this new technology with a large scale laboratory demonstrator of 30-50 kV.

April 2018: 4th FASTGRID Project Meeting at THEVA, Munich

The 4th Technical Meeting for the Horizon 2020 EU Project FASTGRID, jointly managed by CNRS, France, and KIT, Germany was hosted at THEVA Dünneschichttechnik GmbH in Munich Germany on the 17-18 April 2018.

The two-day workshop which included parallel sessions on material development and device research focussed on the application of new generation High Tc superconducting tapes and promising new sapphire substrates for developing MV and HV SFCL for power grids. This high TRL project has already identified five innovations and two patents that are expected out of the research performed within the framework of FASTGRID.

This meeting was also the opportunity to visit the great facilities of THEVA in Ismaning. A lab tour was organised and the members of FASTGRID project had the possibility to know more about the process of manufacturing tapes. Everyone was very impressed by the facility.

Finally, the next face to face meeting of the project members is planned for the 22-23. Nov 2018.

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