Project overview: High-temperature Superconducting Fault Current Limiter

The theoretical investigation and practical testing of current limiter technologies in medium-voltage auxiliary systems of power plants was the objective target of a long-standing research project. Extensive fundamental investigations have shown that limiters based on high-temperature superconductors (HTSL) are most suitable for this task.

The new fault current limiter shows a high adaptability to the conditions of the operation site. This being its main advantage. Due to an appropriate dimensioning it is possible to configure the fault current limiter in such a way that the high maximum operating currents do not cause a limiting process but that the short circuit currents will still be reliably limited to a desired value.

Thus, the previous operation and protection concepts of the auxiliary supply of power plants can be kept to the greatest possible extend for they have proven themselves over a long time. Furthermore, the presently high expenditures for the arcing fault protection of plants can be significantly reduced. HTSL superconducting fault current limiters are newly developed products that are not commercially available yet. With the company Nexans Super Conductors from Cologne (Huerth) a partner was found that was capable of producing a prototype according to the technical specifications of BTU.

In November of 2009, the first limiter prototype based on bulk material (BSCCO; T = 65 K), was put into operation during a one-year field test at unit Q of the Vattenfall power plant in Boxberg. Due to the experiences gained it was decided to carry on with the tests. In the follow-up project ENSYSTROB (development of a newly superconducting YBCO-Tape fault current limiter) a HTSL fault current limiter was developed according to the same requirements of the predecessor but with a novel high-temperature superconducting technology (YBCO tapes; T = 77 K). It was possible to mainly use the existing infrastructure of the previous field test.

Furthermore, the cryogenics was simplified because the YBCO taped conductors were showing evidently fewer losses. This field test was also successful. Due to the simplified cryogenics the robustness of the whole system was further improved. With both field tests the general proof of suitability of the HTSL technology for the use in the fault current limitation, which is a complex task of a coordinated plant and system design, was given.

Funder and Partner: Vattenfall Europe Generation

Production of Prototypes: Nexans SuperConductors, Karlsruhe Institute of Technology (KIT)

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