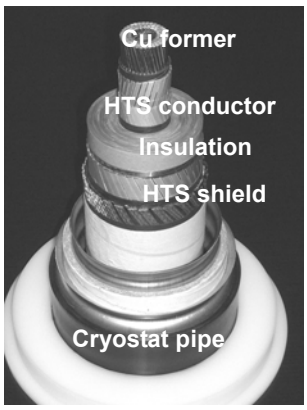
TECHNOLOGIES ALERT

Demonstration of World Highest Voltage Superconducting Cable of 275 kV and 3kA

(1) High-Tc Superconducting Cable

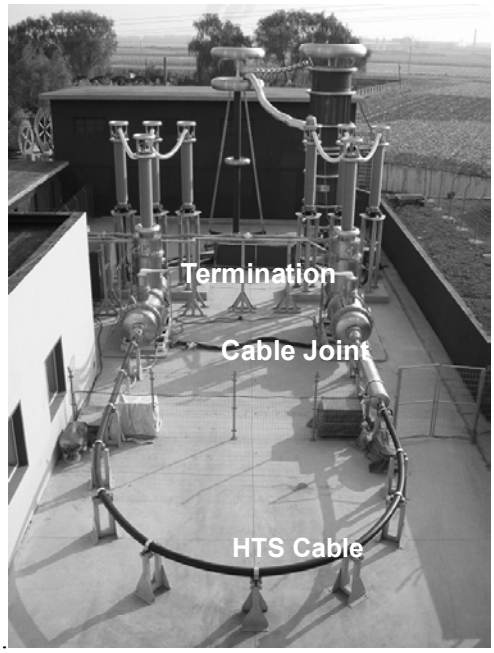
Since a high-Tc superconducting power cable (HTS cable) is capable of carrying massive amounts of electricity with low loss, it is expected to make a contribution to energy savings and the reduction of CO2 emissions. Particularly, the HTS cable made of REBCO wires (2nd generation HTS wire) will be most promising as a large capacity power cable. FEC has developed the highest voltage 275kV HTS cable that enables power transmission of 1.5 GVA,



275kV 3kA HTS cable

(2) Long-term voltage and current loading test

The demonstration test has been conducted at Shenyang Furukawa Cable in China. In the demonstration test, actually, in order to verify a soundness of cable system that consisted of the cable, the termination, and the cable joint in 30 years operation, the HTS cable system has been applied an initial withstand voltage of higher 200kV and 3 kA for one month as an acceleration test. The voltage and current loading test of one month was successfully completed, and any deterioration wasn't detected in the cable system after the long-term test.



Test facility of the long-term test

This works has been achieved in the Technological Development Project for Yttrium Superconducting Electrical Systems, supported by NEDO.

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Supply of DC+/-300kV XLPE Insulation Cable System to Sweden

There are many applications of direct current (DC) power transmission systems in Europe for interconnection of power grids or very long distance power transmission. Alstom Grid (France) are awarded as a contractor of AC/DC converter station at Hurva for the South-West Link project by Svenska Kraftnät in Sweden.

We, VISCAS, supply DC+/-300kV XLPE cable system to Alstom Grid as interconnection cable inside the converter station. The system is bi-pole system. Total four cables are installed to compose two bi-pole systems and outdoor terminations are applied at both ends of the cables. The cables are laid underground. Most part will be "direct buried" but "duct system" will also be applied in road crossing portion.

Main specifications of system are below.

Rated DC voltage	: 300kV
Max. peak voltage	: 315kV
Transmission power	: 360MW
Cable current	: 1200A

Cable is DC+/-300kV XLPE insulated corrugated aluminum sheathed, polyethylene jacketed power cable. The conductor is made of aluminum and 1600mm^2 Milliken conductor. The metallic sheath is annular ring corrugated type and water swellable tapes are

applied underneath to make longitudinal water barrier. The jacket is extruded high-density black polyethylene.

The insulation is specially developed XLPE for DC application and it realizes same leveled allowable conductor temperature of 90°C as well as normal XLPE for AC cable. The thickness is 18mm. Fig.1 shows the cross section of the cable.

Prior to this project, we conducted pre-qualification test and type test for DC+/-320kV class in accordance with CIGRE TB496 "Recommendations for Testing DC Extruded Cable Systems for Power Transmission at a Rated Voltage up to 500kV". The design of cable and the accessories were completely proven in the test.

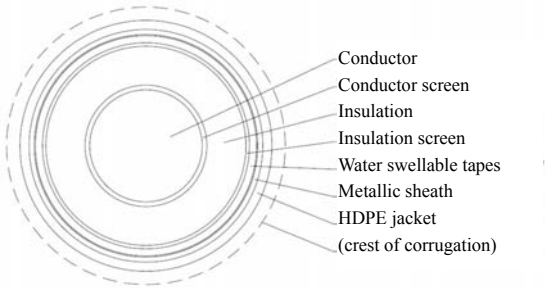

Fig.1 Cable cross section

Cable system with DC+/-300kV is higher record in the field of DC-XLPE application. As Japanese supplier, this is first supply record of DC-XLPE cable system to European market.

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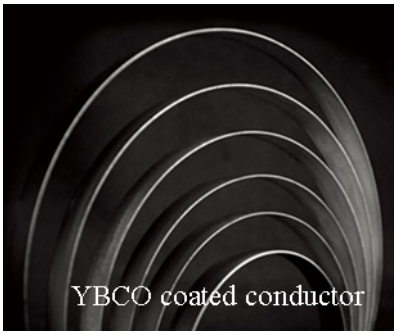
Development of TFA-MOD YBCO Superconducting Coated Conductor

The $YBa_2Cu_3O_y$ (YBCO) high-Tc superconducting coated conductors are well known as one of the candidates of superconducting conductors for practical use. SWCC Showa Cable Systems developed low-cost YBCO coated conductors which are consisted of several layers (see Figure). YBCO coated conductors are fabricated using the metal-organic deposition (MOD) process including trifluoroacetates (TFA) collaborating with SRL-ISTEC since 1999. In 2008, we successfully developed 500 m-class YBCO coated conductors which had the critical current (I_c) values of 310 A/cm-width at 77 K in self field. Moreover, in Materials & Power Applications of Coated Conductors Project, we successfully developed a way for introducing artificial pinning centers (APC) to control the degradation of superconducting properties in magnetic fields. The way was substitutions of Gd for a part of Y elements and introduction of nano-particle $BaZrO_3$, which was a compound of Ba, O and Zr added in the raw material, in the superconducting layer. We successfully fabricated 100m-class YBCO with APC coated conductors which had I_c values of over 50 A/cm-width at 77 K in 3 T. We will improve performance of YBCO coated conductors and develop products of superconducting applications, from now on.

This work was supported by the New Energy and Industrial Technology Development Organization (NEDO).



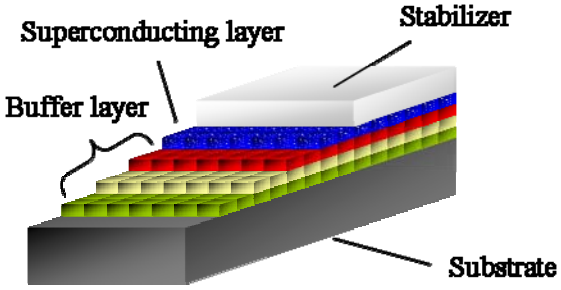


Figure Architecture of the YBCO superconducting coated conductor

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