C.10.1.2.

Material solutions for extruded HVDC cables

M. Berg kVist[1], A. Campus[2], P. Carstensen[1], A. Farkas[3], R.N. Hampton[2], J. Jonsson[1], M. Jeroense[3], U. H. Nilsson[2] & N. Zebouchi[1]
[1] ABB, Group Services Center AB, Corporate Research, Västerås, Sweden
[2] Borealis AB, Stenungsund, 444 86, Sweden
[3] ABB Power Technology Products AB, Karlskrona, Sweden

In recent years special materials (insulations and semicons) have been developed to enable the manufacture of extruded DC transmission cable [1,2]. These materials have been engineered to have a unique set of properties. They combine the cleanliness, extrudability and high temperature performance now expected of crosslinked materials with the specific electrical properties required for operation under divergent DC fields. The correct combination of critical material properties has been achieved through a detailed development programme, which has considered the specific requirements of both cable manufacture and cable operation. Since 1999 these bespoke crosslinked DC material have been proven in a number of practical applications around the world [2,3], which now account for > 1000 km of installed cables.

This paper will further describe how the development of insulation and screening materials has supported the commercial evolution of extruded HVDC cable technology. Particular focus will be placed on the assurance protocols that have been used to assure the longevity of crosslinked DC materials (Figure 1 & Figure 2). The influence of some of the challenging aspects of DC technology on the material solutions (insulations and semicons) will be explored in detail.

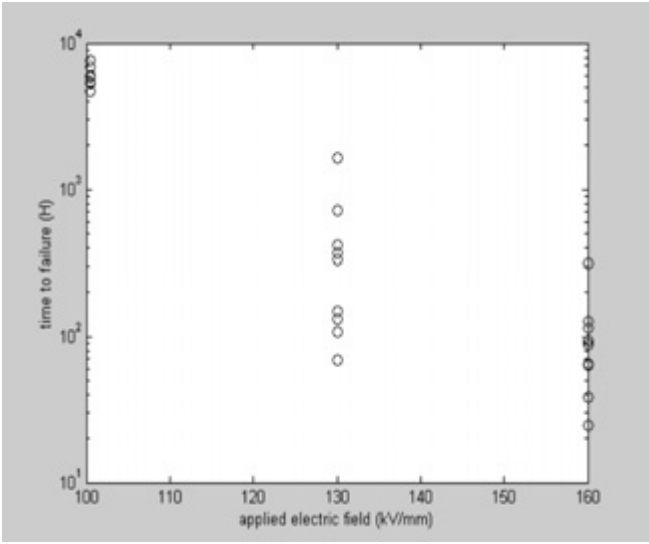

Fig. 1. Endurance of a crosslinked HVDC material system at selected DC stresses

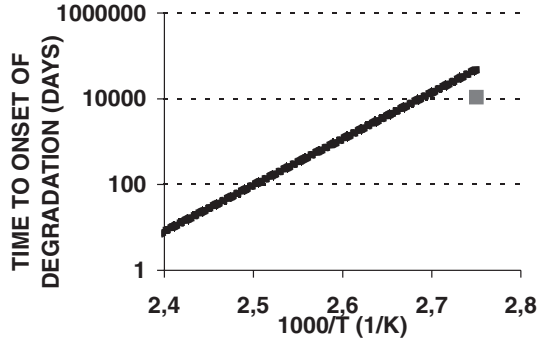

Fig. 2. Temperature dependence of the time to onset of degradation for a crosslinked HVDC insulation: square indicates cable operation at 90°C

REFERENCES

[1] Boström JO, Campus A, Nilsson UH, Carstensen P, Gustafsson A, Farkas AA, Johannesson K; "Cross-linked polyethylene materials for dc power cables", Proc. Fifth International Conference on Insulated Power Cables, JICABLE 1999, Paris, Paper C2.12, page 713-717.

[2] Byggeth M, Johannesson K, Liljegren C, Palmqvist L, Axelsson U, Jonsson J & Torn kVist C; "The development of an extruded HVDC cable system and its first application in the Gotland HVDC Light project", Proc. Fifth International Conference on Insulated Power Cables, JICABLE 1999, Paris, Paper B7.5, page 538-542.

[3] Ruter F, Parpal JL, Swingler SG, "A review of HVDC extruded cable systems", CIGRE 2000 P2-3.