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Influence of polypropylene content in PPLP for high voltage insulation at cryogenic temperature

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Abstract:

It has been demonstrated that high power superconducting cables can carry electric power over long distances with less overall power loss than conventional technologies. Among the various possibilities for the cable insulation, impregnated materials such as polypropylene lapped paper (PPLP) have focused great interest. However the content of polypropylene in PPLP has not been studied in the representative geometry of a cable.

Within the frame of SCARLET European project, experiments were carried out in liquid nitrogen to compare two PPLP samples, one with 43% polypropylene content, the other with 55% polypropylene content. The samples consist in 4 or 5 layers of lapped paper wound onto a stainless steel tube which is representative to a cable structure in terms of diameter, strip tension and gap between strips. Dielectric breakdown tests were performed in a specific cryostat including a moving spark point in order to leave the sample at targeted conditions.

It is shown that breakdown voltage increases with hydrostatic pressure and that the larger the polypropylene content the higher the breakdown voltage. In addition, multiple breakdowns at the same point show obviously a reduction of the structure breakdown strength though it remains relatively high to keep the cable working in degraded mode.

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