REVIEW OF TECHNOLOGICAL ADVANCES IN HIGH TEMPERATURE OVERHEAD LINE COMPOSITE CONDUCTORS

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Abstract

ACSR (Aluminium Conductor Steel Reinforced) conductors consisting of pure aluminium wires helically stranded around a core of high strength galvanized steel core wires are widely used in overheated transmission line applications. While the steel wires provide the required strength, the outer aluminium serves as electricity conducting member. The thermal rating or ampacity of conductors is the maximum current that a circuit can carry within the temperature limits as dictated by the allowable conductor sag or by the annealing onset temperature of the conductor, whichever is lower. On a continuous basis, ACSR may be operated at temperatures up to 100 °C without any significant change in the conductor's physical properties. Above 100 °C, aluminium wires loses tensile strength over time and becomes "fully annealed" giving rise to increased thermal expansion of the conductor; this causes excessive sagging reducing the clearance between the ground and the energized conductors.

While, the electric utilities are posed with increased challenges of production of additional capacities and building new transmission circuits to meet the ever growing demand and the high cost and environmental restrictions of constructing new lines, methods are being explored to increase their capacity with minimum changes in the existing towers. Replacement of the existing conductor with a advanced high temperature composite (HTC) conductors operating upto temperatures of 200 °C with reduced sagging characteristics have been attempted and an increase in capacity of 30-80%, can be achieved through application of these composite conductors.

The advanced HTC conductors with varied combinations of core material and outer conducting wires are being tried so as to achieve wide ranging properties. In general, an HTC conductor features the combinations of either soft aluminium wires with ultra high strength steel or

temperature resistant aluminium with or fiber reinforced metal/polymer matrix composites as the core. Both the alumina fiber reinforced temperature resistant aluminium metal matrix composite and the carbon fiber reinforced high temperature polymer resin composite wires as the core material appears to have favourable applications. The comparative performance of the HTC depends on the degree to which both outer aluminium strand and reinforcing core's physical properties are stable at high temperature and on the elastic, plastic, and thermal elongation of the combined HTC.

The summary of various developments realized in the area of composite conductors and their relative merits and demerits have been discussed in detail.