Fabrication of a Scaled MgB\(_2\) Racetrack Demonstrator Pole for a 10 MW Direct Drive Wind Turbine Generator

N. Magnusson, M. Paulsen, J.C. Eliassen, A.B. Abrahamsen, S.M. Hellesø, M. Runde, A. Nysveen, L.E. Moslått, J. Bjerkli and P. King

SINTEF Energy Research, Trondheim, Norway
Norwegian University of Science and Technology, Trondheim, Norway
Technical University of Denmark, Roskilde, Denmark

0.5 m wide and 1 m long racetrack coil

- MgB\(_2\) superconductor: \(I_c = 373\) A at 1.8 T and 16 K
- 0.5 mm x 3 mm Ni-matrix wire
- 0.2 mm copper strip on one side
- Reduced straight section compared to full-scale pole
- Built up of double pancake coils

Winding

- Wet-winding: epoxy applied to wire during winding
- Epoxy serves as electrical insulation
- Tuning of epoxy layer thickness important
- One work day to wind a coil
- Straight section tends to be wider than end section

Coil assembly

- Double pancake coils glued one by one to thermal interface
- Soldering performed with a soldering iron with two plates pressing the wires together with a spring system
- 80 µm tin layers yield resistances in the 40 – 50 nΩ range

Mechanical support

- Electromagnetic forces of 110 kN at 225 A
- 5 mm thick stainless steel plates heavily oversize the support
- Detailed analysis at the holes necessary to optimize the support

Conclusions

- Several practical issues solved for wet-winding of racetrack MgB\(_2\) coil
- Subsequent testing necessary to validate the winding method