PHYSICS

ENI - REBCO coil design and simulation with innovative methods for winding, insulation, power supply, and quenching control

Funded By	ENI S.P.A. [P.iva/CF:00905811006]
Supervisor	LAVIANO FRANCESCO - francesco.laviano@polito.it
Contact	antonio trotta
Context of the research activity	Experimental activity in superconductivity: characterization of superconducting samples for what concerns electromagnetic and structural properties; technological assessment of industrial superconducting products, along with developing novel methods for windings superconducting coils, their coupling (insulation, partial insulation or no insulation); designing power supply for charging/discharging superconducting magnets; study of innovative quenching detection and protection systems.
Objectives	The PhD candidate will perform extensive characterization of superconducting samples, starting from pure single crystals and film deposited on crystalline substrate to commercial second generation REBCO tapes. Both electromagnetic and structural characterization will be done for obtaining a thorough knowledge of fundamental properties and engineering parameters as well. Electromagnetic characterization will include ac and dc electrical transport, ac and dc magnetization, magnetic imaging and response to pulsed current. Structural characterization will include X-ray diffraction, X-ray spectroscopy, Raman spectroscopy, SEM and TEM. Samples will be prepared for each measurement by means of laser patterning and/or optical photolithography, wet and dry selective etching, laser machining. Design of the REBCO devices will be pursued by CAD and FEM simulations. Windings of REBCO coils will be performed both at Politecnico di Torino and in external laboratories (e.g., INFN facilities). Study of innovative solutions for REBCO tape coupling, for what concerns both electrical insulation and mechanical stability, will be carried out by means of coil mock-ups, along with extensive diagnostics for magnetic field and coil stability control. Particular attention will be devoted to quenching detection and control.
Skills and competencies for the development of	Solid state physics; experimental physics; electromagnetic characterization; structural characterization.

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