CHEMICAL ENGINEERING

CRT/DISAT - Development of a catalytic system for the abatement of pollutants from H2-ICEs

Funded By	Dipartimento DISAT FONDAZIONE CRT CASSA DI RISPARMIO DI TORINO [P.iva/CF:06655250014]
Supervisor	DEORSOLA FABIO ALESSANDRO - fabio.deorsola@polito.it
Contact	FINO DEBORA - debora.fino@polito.it BENSAID SAMIR - samir.bensaid@polito.it
Context of the research activity	The research activity is related to the development of an after-treatment system for Hydrogen-fueled Internal Combustion Engines (H2-ICEs). The study will focus on the abatement of nitrogen oxides as main pollutants by exploring different catalytic systems. Detailed analyses of the interactions between the catalysts and the molecules as well as kinetic and mechanistic investigations will be carried out by advanced operando and in-situ characterization techniques. “Dipartimento di Eccellenza 2023-2027 - Ministero dell'Università e della Ricerca”.
Objectives	The research activity is related to the development of an after-treatment system for Hydrogen-fueled Internal Combustion Engines (H2-ICEs). Nowadays, they represent a promising CO2-free and zero-impact emission alternative to fuel cell electric powerunits. Apart from uncritical nitrogen, oxygen and water vapor, nitrogen oxides (NOx) are the only major pollutant. Exhaust gas aftertreatment systems (EATS) are used to further reduce the NOx raw emissions. To achieve zero-impact tailpipe emissions, where the concentration of pollutant does not affect air quality, a devoted system must be developed. The study will focus on the abatement of nitrogen oxides emissions by exploring different catalytic options (NSC, PNA, SCR) derived from established and low-cost solutions and operated in the conditions typical of H2-ICEs. The activity will include the synthesis of the catalysts by innovative and low-cost routed, their chemical-physical characterization and the evaluation of the catalytic performance in the conditions proper of H2-ICE exhaust gases in terms of concentration of chemical species and temperatures. Detailed analyses of the interactions between the catalysts and the molecules as well as kinetic and mechanistic investigations will be carried out by advanced operando and in-situ characterization techniques. The most promising catalytic system will be tested in an upscaled device in conditions similar to the real ones.

Skills and competencies for the development of the activity	Theoretical and experimental knowledge of heterogeneous catalysis, synthesis and characterization of catalysts, chemical-physical analyses (including microscopy and spectroscopy techniques), evaluation of catalytic activity, use and management of experimental pilot bench plants.