A.D. 1308
unipg
DIPARTIMENTO
DI INGEGNERIA
DIPARTIMENTO DI ECCELLENZA
MUR 2023/2027

A.D. 1308
unipg
DIPARTIMENTO
DI INGEGNERIA
CIVILE E AMBIENTALE

AVVISO DI SEMINARIO

martedì 16 Settembre 2025

ore 16:30 Auletta vicino all'Aula Magna - POLO DI INGEGNERIA

il Prof. Vaclav Nevrlý

Associate Professor | Researcher in Industrial Safety, Combustion & Laser Diagnostics
Faculty of Safety Engineering | VŠB – Technical University of Ostrava | Czech Republic

terrà il seminario dal titolo:

Targeting transient species in ultra-lean flames

Understanding the reactivity of transient species in ultra-lean flames addresses critical challenges in both fire safety science and environmental engineering. The ultra-lean combustion regime extends the flammability concept beyond traditional limits, creating new fire and explosion hazard scenarios while simultaneously offering pathways toward sustainable combustion with reduced emissions. However, the growing adoption of alternative fuels—particularly ammonia-based systems—raises concerns about previously overlooked combustion products such as N_2O, whose elevated emissions pose environmental threats as both a greenhouse gas and an ozone-depleting substance. Our previous investigations, employing wavelength-modulation spectroscopy, have demonstrated in-situ OH radical measurements in laminar flames under atmospheric conditions, confirming both the applicability and sensitivity of this diagnostic technique. Building on these results and recent numerical simulation findings, forthcoming experimental campaigns will focus on HO_2 radicals, given their pivotal role in low-temperature oxidation pathways and their influence on pollutant formation mechanisms, including N_2O production routes. Detailed chemical-kinetic modeling at macroscopic scales yields essential insights into temperature and species concentration profiles within reaction zones. Both simplified one-dimensional kinetic models and realistic simulations of laboratory-scale burner geometries are applied to characterize laminar flame structures and support interpretation of experimental data. Comprehensive uncertainty and sensitivity analyses of these detailed kinetic models are indispensable for understanding how parametric variations affect combustion behavior, particularly in oxygenated fuel systems such as DME/air mixtures, where rigorous input–output mapping is required for robust model validation. Current laboratory projects focus on integrating advanced non-invasive diagnostics—including cavity-enhanced absorption spectroscopy, optical frequency combs, and multidimensional laser-induced fluorescence imaging—with computational fluid dynamics simulations. This combined approach enables robust model validation and yields deeper insights into flame structure and dynamics, supporting the development of novel superadiabatic burners, for example in thermophotovoltaic systems. We employ a relatively simple additive manufacturing method to fabricate tailored porous structures or Swiss-roll-type architectures using commercially available ceramic-based resins and commonly used 3D-printing technologies.

Tutti gli interessati sono invitati a partecipare,
Proff. Manuela Cecconi e Stefano Falcinelli

Václav Nevrlý is an associate professor and researcher with a multidisciplinary expertise spanning industrial safety, combustion chemistry, and molecular spectroscopy. Based at the Faculty of Safety Engineering, VŠB–Technical University of Ostrava, he actively contributes to both national and international research projects and co-authors peer-reviewed publications focused mostly on application of spectroscopically–based experimental methods for atmospheric sensing and combustion diagnostics. Over more than two decades, he has held leadership roles in laboratory-scale research activities, mentored numerous MSc. and Ph.D. candidates, and fostered international collaborations. His dedication to the popularisation of science extends beyond academia; in the past five years, he has been intensively involved in shaping a democratic school environment in primary education through innovative STEM (Science, Technology, Engineering, Mathematics) learning initiatives. Dr. Nevrlý is the author or co-author of more than 35 research papers with H-index of 11 (Web of Science) and two reviews (book chapters). His current research interests focus on ultra-lean flames, laser-based combustion diagnostics, and gas sensing in porous materials. ORCID: 0000-0003-4606-3966, Researcher ID: H-1454-2014