# Catalytic combustion of volatile organic compounds

# Combustion catalytique de composés organiques volatiles

**Level:** **PhD offer**

**Profile of the candidate:** Masters degree in catalysis or physical chemistry or chemical engineering. Good spoken and written English is required.

**Team(s):** IRCELYON, ING/CARE groups

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**Keyword(s):** Volatile Organic Compounds; Catalytic combustion**;** in-situ FTIR spectroscopy; catalyst deactivation, chlorine- and sulphur-containing compounds.

**Scientific context:** Volatile Organic Compounds (VOCs) are major contributors to air pollution. They are emitted in the atmosphere by various industrial sources (chemical plants, refineries, industrial food processes, transportation, agricultural processes), but also in indoor air by paints, insulation materials, cleaning products, furniture. They are harmful to human health and environment and their emissions are strictly regulated, which requires efficient processes for VOCs abatement.

Catalytic combustion is an efficient method for VOCs removal, but the large variety of VOCs nature and composition requires specific catalyst developments for each targeted pollutant or mixture of pollutants. Some VOCs, specifically chlorine- and sulphur-containing compounds, are catalysts poisons, leading to their deactivation. The catalysts should ensure low-temperature activity with high selectivity towards non-toxic products, at low cost. They should also exhibit high resistance to deactivation, and be easily recycled. Furthermore, the reaction mechanism over catalysts surface and the identification of the intermediates species, especially in the process of VOCs oxidation, is still unclear. Therefore, the development of an effective method to better understand these catalytic reactions is essential.

**Missions :** The objective of this thesis is the development of VOCs combustion catalysts, with emphasis on a fundamental study of their performances in the presence of VOCs mixtures. The selected catalysts will be based on non-noble metals or very low noble metals content formulations, with the objective of improving the catalysts performances through metal/support synergy and the control of surface

area and porosity. The catalysts will be tested for the abatement of various types of VOCs that will represent the main VOC families, alone and in mixtures. The study will address the adsorption competition between the different types of VOCs, using in-situ DRIFT spectroscopy and transient experiments to identify active intermediate species and to better understand the reaction and deactivation mechanisms.

**References:** C. Zhang et al., Appl. Catal. B: Environm. 186 (2016) 173; S.I. Suarez-Vazquez et al., Appl. Catal. B, 223 (2018) 201.

**Application:** Please send CV, motivation letter, copy of M1 and M2 grades, one or two recommendation letters including contact information **until May 20$^{th}$, 2020.**