CO abatement via Ir-based catalysts: effect of the support nature and preparation method on catalytic activity and stability

DROSOU C.1, FOUNTOULI T.V.1, CHARISIOU N.D.2 GOULA M.A.2,\* and YENTEKAKIS I.V.1,\*

1 Laboratory of Physical Chemistry & Chemical Processes, School of Environmental Engineering, Technical University of Crete, GR-73100 Chania, Greece

2 Laboratory of Alternative Fuels and Environmental Catalysis (LAFEC), Department of Chemical Engineering, University of Western Macedonia, GR-50100, Greece

\*corresponding authors:

e-mail: yyentek@isc.tuc.gr (I.V. Yentekakis) and mgoula@uowm.gr (M.A. Goula)

**Abstract**

In the present study the effect of the support nature and preparation method on the CO abatment catalytic activity and stability of nanostructured 1.0 wt% Ir-based catalysts is investigated in detail. More specifically, the effect of Al2O3-Cex-Zr1-xO2 (ACZ, x=0, 0.25, 0.5 and 0.75) mixed oxide supports with high oxygen ion lability and surface oxygen vacancies in comparison to the bare Al2O3, on both activity and stability of Ir nanoparticles supported on them is investigated at the temperature range 50-400oC. The composite supports were prepared following two different methods: (i) co-precipitation (ACZ-P) and (ii) hydrothermal method (ACZ-H) in order this study to deal also with the effect of the preparation method on catalysts’ performance. The textural and stuctural properties of the supports and the counterpart Ir-supported catalysts were evaluated by various techniques, such as X-ray diffraction (XRD), BET-BJH N2 adsorption-desorption method, temperature-programmed reduction by H2 (H2-TPR) and isothermal H2 chemisorption (H2-Chem). Catalytic tests were conducted under both integral (light-off) and differential (turnover frequency) reaction conditions using excess O2 (1.0% v/v CO, 5.0% v/v O2). The results demonstrated that Ir-ACZ-H catalysts have higher BET surface area and pore volume, higher Ir-dispersion and present better CO abatement efficiency and stability than Ir-ACZ-P. Substantial influences of the support nature on the CO oxidation performance (activity and stability) were also recorded.

**Keywords:**CO oxidation, Iridium catalysts, Nanocatalysis, Ceria-zirconia composites

**Acknowledgements:** Financial support by the *GREEK-CHINESE BILATERAL RESEARCH AND INNOVATION COOPERATION, 2018-2021 programmee (Project No: T7ΔΚI-00356) is gratefully acknowledged.*

