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*Abstract*

# From Organometallic Chemistry to Multifunctional Nanoparticle-Based Devices for Gas Detection and Degradation of Air Pollutants †

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Considering the climate, societal and health-related current and emerging issues facing the world, our group, as part of the (nano-)material science community, will play a part in providing materials and technology that can tackle these issues. Our strategy focuses on the design and development of complex hybrid nano-objects and nanomaterials with unprecedented properties, with the aim of developing functional and innovative solutions to societal challenges (Figure 1). To achieve this, we are applying an organometallic approach for the synthesis of well-defined nanoparticles (NPs) and nanomaterials [1]. This bottom-up approach allows control of the NPs synthesis (size, shape, colloidal stability) on a molecular level with the help of cleverly designed starting molecular precursor(s), under mild reaction conditions and in safe-by-design approaches [2]. The presentation will focus on our team's research related to the synthesis and properties of NPs and nanomaterials, their implementation into devices for either gas detection (i.e., sensors based on Cu [3], Zn [4,5], and Sn oxide NPs [6,7]) or degradation of air pollutants [8], and the interconnection between different fields (chemistry, physical chemistry, physics, and biology).

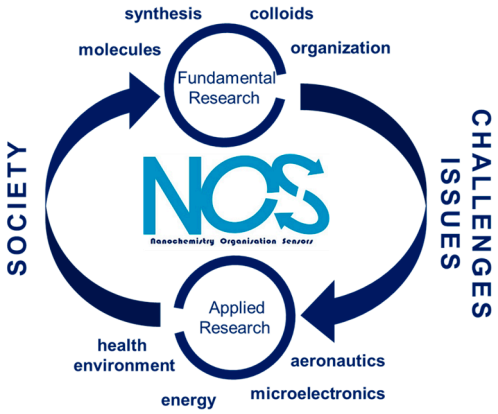


**Figure 1.** Positive feedback loop on the development of new nanomaterials and technological solutions to societal needs.

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## References

1. Amiens, C.; Chaudret, B.; Ciuculescu-Pradines, D.; Collière, V.; Fajerwerg, K.; Fau, P.; Kahn, M.; Maisonnat, A.; Soulantica, K.; Philippot, K. Organometallic approach for the synthesis of nanostructures. *New J. Chem.* **2013**, *37*, 3374–3401. [CrossRef]
2. Carnide, C.; Champouret, Y.; Valappil, D.; Vahlas, C.; Mingotaud, A.-F.; Clergereaux, R.; Kahn, M.L. Secured Nanosynthesis–Deposition Aerosol Process for Composite Thin Films Incorporating Highly Dispersed Nanoparticles. *Adv. Sci.* **2022**, *10*, 2204929. [CrossRef] [PubMed]
3. Jońca, J.; Ryzhikov, A.; Palussière, S.; Esvam, J.; Fajerwerg, K.; Menini, P.; Kahn, M.L.; Fau, P. Organometallic Synthesis of CuO Nanoparticles: Application in Low-Temperature CO Detection. *ChemPhysChem* **2017**, *18*, 2658–2665. [CrossRef] [PubMed]
4. Jońca, J.; Ryzhikov, A.; Kahn, M.L.; Fajerwerg, K.; Chaudret, B.; Chappelle, A.; Menini, P.; Fau, P. Shape-controlled ZnO Nanistructures for Gas Sensing Applications. *Procedia Eng.* **2014**, *87*, 907–910. [CrossRef]
5. Ryzhikov, A.; Jońca, J.; Kahn, M.; Fajerwerg, K.; Chaudret, B.; Chappelle, A.; Menini, P.; Shim, C.H.; Gaudon, A.; Fau, P. Organometallic synthesis of ZnO nanoparticles for gas sensing: Towards selectivity through nanoparticles morphology. *J. Nanopart. Res.* **2015**, *17*, 280. [CrossRef]
6. Jońca, J.; Ryzhikov, A.; Fajerwerg, K.; Kahn, M.L.; Chaudret, B.; Chappelle, A.; Menini, P.; Fau, P. A Novel $SnO_2$ Sensor and its Selectivity Improvement with Catalytic Filter. *Procedia Eng.* **2014**, *87*, 923–926. [CrossRef]
7. Jońca, J.; Ryzhikov, A.; Kahn, M.L.; Fajerwerg, K.; Chappelle, A.; Menini, P.; Fau, P. $SnO_2$ "Russian Doll" Octahedra Prepared by Metalorganic Synthesis: A New Structure for Sub-ppm CO Detection. *Chem. Eur. J.* **2016**, *22*, 10127–10135. [CrossRef] [PubMed]
8. Castelló Lux, K.; Hot, J.; Fau, P.; Bertron, A.; Kahn, M.L.; Ringot, E.; Fajerwerg, K. Nano-gold decorated ZnO: An alternative photocatalyst promising for $NO_x$ degradation. *Chem. Eng. Sci.* **2023**, *267*, 118377. [CrossRef]