



**HAL**  
open science

# Catalytic Strategies for the Reductive Functionalization of CO<sub>2</sub>

T. Cantat

► **To cite this version:**

T. Cantat. Catalytic Strategies for the Reductive Functionalization of CO<sub>2</sub>. 5th CARISMA meeting - "Catalytic Routines for Small Molecule Activation", Mar 2017, Lisboa, Portugal. cea-02341709

**HAL Id: cea-02341709**

**<https://cea.hal.science/cea-02341709>**

Submitted on 31 Oct 2019

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

## Catalytic Strategies for the Reductive Functionalization of CO<sub>2</sub>

T.Cantat\*

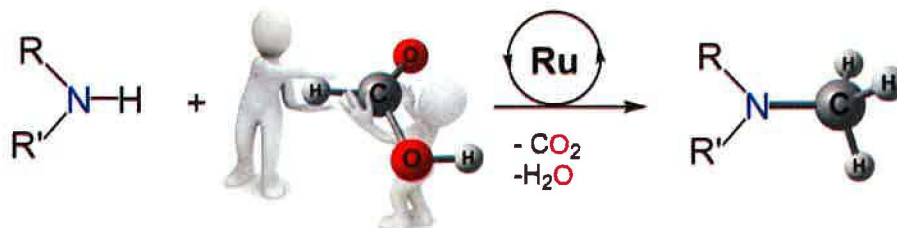
NIMBE, CEA, CNRS, Université Paris-Saclay,

CEA Saclay 91191 Gif-sur-Yvette, France

e-mail: [thibault.cantat@cea.fr](mailto:thibault.cantat@cea.fr)



While greenhouse gases emissions are reaching alarming levels, fossil fuels still represent 80% of the world energy portfolio and 95% of our chemical commodities rely on non-renewable resources, namely hydrocarbons. In this context, utilizing CO<sub>2</sub> as a C<sub>1</sub> building block to produce platform chemicals as an alternative to petrochemistry has a double advantage of reusing CO<sub>2</sub> while sparing fossil resources and avoiding CO<sub>2</sub> emissions from their use. We have developed a strategy relying on the simultaneous use of a functionalizing reagent and a reductant that can be *independently* adjusted to perform the reductive functionalization of CO<sub>2</sub>. The so-called *diagonal approach* will be discussed and exemplified with novel catalytic processes to convert CO<sub>2</sub> to formamides, N-heterocycles, methylamines and methanol, using hydroboranes, hydrosilanes or formic acid as reductants. These new catalytic reactions rely on the use of simple organocatalysts or Zn, Fe and Ru organometallic complexes. The mechanisms at play in these transformations will be presented, based on DFT calculations and isolation of reactive catalytic intermediates.[1-9]



### References

1. Gomes, C. D.; Jacquet, O.; Villiers, C.; Thuéry, P.; Ephritikhine, M.; Cantat, T. *Angew. Chem. Int. Ed.*, **2012**, *51*, 187-190.
2. Jacquet, O.; Gomes, C. D.; Ephritikhine, M.; Cantat, T. *J. Am. Chem. Soc.*, **2012**, *134*, 2934-2937.
3. Jacquet, O.; Frogneux, X.; Gomes, C. D.; Cantat, T. *Chem Sci*, **2013**, *4*, 2127-2131.
4. Pouessel, J.; Jacquet, O.; Cantat, T. *ChemCatChem*, **2013**, *5*, 3552-3556.
5. Jacquet, O.; Gomes, C. D.; Ephritikhine, M.; Cantat, T. *ChemCatChem*, **2013**, *5*, 117-122.
6. Savourey, S.; Lefèvre, G.; Berthet, J.-C.; Thuéry, P.; Genre, C.; Cantat, T. *Angew. Chem. Int. Ed.*, **2014**, *53*, 10466-10470.
7. Blondiaux, E.; Pouessel, J.; Cantat, T. *Angew. Chem. Int. Ed.*, **2014**, *53*, 12186-12190.
8. Chauvier, C.; Tlili, A.; Gomes, C. D.; Thuéry, P.; Cantat, T. *Chem Sci*, **2015**, *6*, 2938-2942.
9. Cantat T. *et al.*, Patent applications n° WO 2012/137152, PCT/IB2013/054601, PCT/IB2013/054599, FR1259757, FR1352996.
10. Chauvier, C.; Thuéry, P.; Cantat, T. *Angew. Chem. Int. Ed.*, **2016**, *55*, 14096-14100.