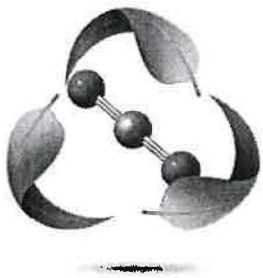
Catalytic Reductive Functionalization of CO_2: An Entry to Chemicals from CO_2

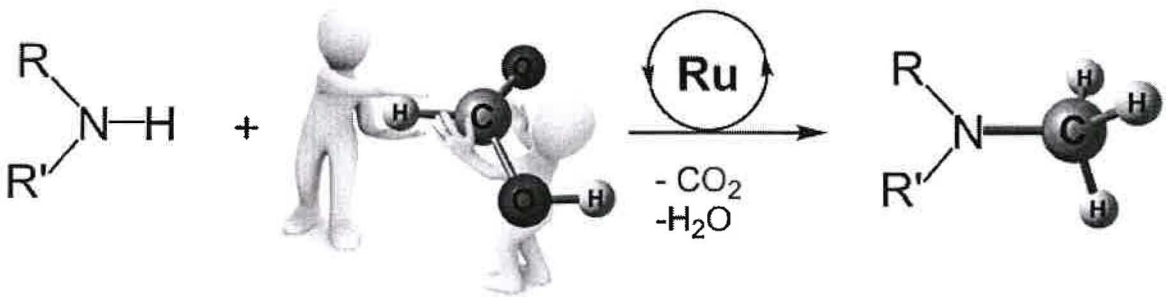
T. Cantat

Catalytic Reductive Functionalization of CO_2: An Entry to Chemicals from CO_2

Thibault Cantat
CEA Saclay – Physical Sciences Division
DSM / IRAMIS / NIMBE UMR CEA/CNRS 3685; 91191 Gif-Sur-Yvette Cedex, France
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_2 as a C_1 building block to produce platform chemicals as an alternative to petrochemistry has a double advantage of reusing CO_2 while sparing fossil resources and avoiding CO_2 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_2. The so-called *diagonal approach* will be discussed and exemplified with novel catalytic processes to convert CO_2 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.; Thuery, 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. S. Savourey, G. Lefèvre, J.-C. Berthet, P. Thuéry, C. Genre, T. Cantat, *Angew. Chem. Int. Ed* , **2014**, *53*, 10466-10470.
7. E. Blondiaux, J. Pouessel, T. Cantat, *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, WO 2013/182993, WO 2013/182991, WO 2014/162266, WO 2014/057466, PCT/IB2013/054601, PCT/IB2013/054599, FR1259757, FR1352996.