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► **To cite this version:**

T. Cantat. CO₂ and formic acid, a winning couple to improve the sustainability of catalytic hydrosilylation and hydroboration chemistry. XXVIII International Conference on Organometallic Chemistry, Jul 2018, Florence, Italy. cea-02340789

HAL Id: cea-02340789

<https://cea.hal.science/cea-02340789>

Submitted on 31 Oct 2019

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CO₂ and formic acid, a winning couple to improve the sustainability of catalytic hydrosilylation and hydroboration chemistry

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Hydrosilanes (R₃SiH) and hydroboranes (R₂BH) are appealing reductants in the reduction and functionalization of C=O and C-O bonds,^{1,2} because they combine mild redox properties with polarized Si-H and B-H bonds. These main group hydrides have thus been utilized with success in the conversion of renewable feedstocks, such as CO₂, waste plastics and biomass wastes.^{2,3} Hydrosilanes and hydroboranes are however disposable hydride donors and they generate stoichiometric amounts of oxidized wastes, in the form of siloxanes and boroxanes. To improve the sustainability of these main group hydrides, our group has recently investigated the design of energy efficient surrogates, by exploiting formic acid as a renewable hydride donor.⁴ Formic acid can be generated by electroreduction of CO₂ and it is commonly employed to generate hydrides in transition metal chemistry.^{3,5} We have recently investigated the reductive properties of silylformates (R₃SiOCHO), readily formed from siloxanes and formic acid: using tailored organometallic complexes, silylformates can act as surrogates of hydrosilanes and promote the reduction of carbonyl groups by transfer hydrosilylation. The utilization of silylformates and borylformates will be presented in the reduction and functionalization of C=O and O-H bonds from the perspective of catalysis, mechanisms and main group element synthetic chemistry.^{4,6-8}

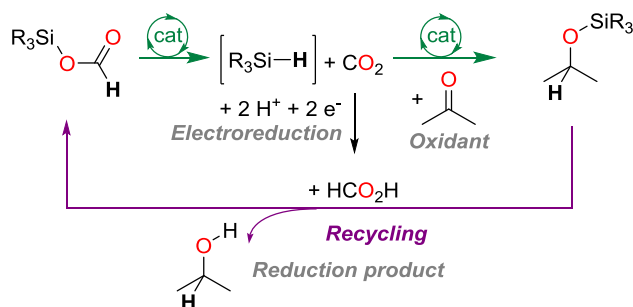


Figure 1. Utilization of silylformates as renewable surrogates for hydrosilanes in reduction chemistry

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