

# Uranyl.triflate as selective catalyst in the hydrosilylation of aldehydes

Jean-Claude Berthet, Louis Monsigny, Pierre Thuéry, Thibault Cantat

► **To cite this version:**

Jean-Claude Berthet, Louis Monsigny, Pierre Thuéry, Thibault Cantat. Uranyl.triflate as selective catalyst in the hydrosilylation of aldehydes. GECOM-CONCOORD 2019, May 2019, Erquy, France. cea-02329560

**HAL Id: cea-02329560**

**<https://hal-cea.archives-ouvertes.fr/cea-02329560>**

Submitted on 23 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.

## Uranyl triflate as selective catalyst in the hydrosilylation of aldehydes

Jean-Claude Berthet,\* Louis Monsigny, Pierre Thuéry, Thibault Cantat\*

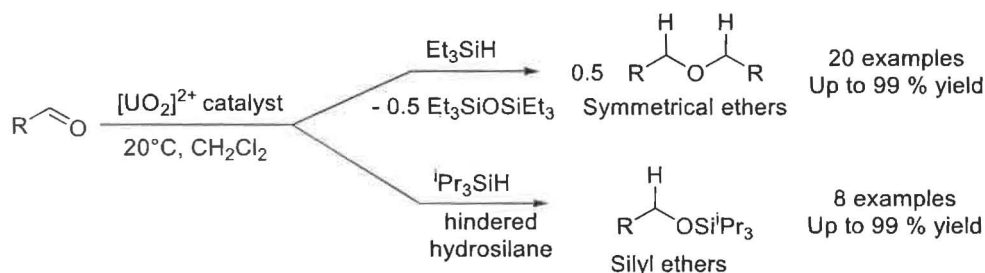
NIMBE, CEA, CNRS, Université Paris-Saclay, CEA Saclay, 91191 Gif-sur-Yvette, France

Email: jean-claude.berthet@cea.fr; thibault.cantat@cea.fr

The chemistry of uranium has attracted considerable attention in industrial and environmental fields and fundamental researches have revealed unique chemical features of this element. For years, transformation of oxygenated compounds with actinide catalysts was not considered due to the strength of the actinide-oxygen bond that should preclude efficient catalytic turnover. However, this idea vanished in 2008 when the group of Eisen unveiled the ability of actinide(IV) complexes (U and Th) to promote the catalytic dimerization of aldehydes.<sup>1</sup> A few reports now describe activation of oxygen substrates with  $U^{4+}$ ,  $Th^{4+}$  and  $[UO_2]^{2+}$  complexes.<sup>2</sup>

While the reduction of oxygenated substrates, involving the cleavage of C–O and/or C=O bonds, is of fundamental importance, the utilization of actinide catalysts in this area is extremely rare. In particular, hydrosilanes ( $R_3SiH$ ) have never been combined with the 5f elements for the reduction of carbonyl groups although the slight polarization of the Si–H bond displays advantages for the development of selective reduction processes in organic chemistry, the valorization of biomass,<sup>3</sup> and the recycling of plastics.<sup>4</sup>

Here, we report the first use of an actinide complex to carry out catalytic hydrosilylation of C=O bonds.<sup>5</sup> The



**Scheme 1** : hydrosilylation of aldehydes catalyzed by  $[UO_2(OTf)_2]$

uranyl cation  $[UO_2]^{2+}$ , which is the most oxidized uranium fragment ubiquitous in the environment and in the nuclear industry, proved, as the uranyl triflate species, an efficient catalyst in the reductive hydrosilylation of aldehydes into symmetric ethers and silylated alcohols depending on the nature of the hydrosilane (Scheme 1). The reactions also show that, although the uranyl ion contains oxidizing U=O bonds, reduction of the C=O group and C–O bond cleavage are possible without loss of integrity of the uranyl moiety.

1- T. Andrea, E. Barnea, M. S. Eisen, *J. Am. Chem. Soc.*, **2008**, 130, 2454-2455

2- P.L. Arnold, Z. Turner, *Nature Rev. Chem.*, **2017**, 1-16; A. R. Fox, S. C. Bart, K. Meyer, C. C. Cummins, *Nature*, **2008**, 455, 341-349; K. Takao, S. Akashi, *RSC Adv.*, **2017**, 7, 12201-12207.

3- L. Monsigny, E. Feghali, J.-C. Berthet, T. Cantat, *Green Chem.*, **2018**, 20, 1981-1986

4- L. Monsigny, J.-C. Berthet, T. Cantat, *ACS Sustainable Chem. Eng.*, **2018**, 6, 10481-10488.

5- L. Monsigny, P. Thuéry, J.-C. Berthet, T. Cantat, *submitted*