

Novel photo- and organo-catalytic reactions for the construction of C-C bonds

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Novel photo- and organo-catalytic reactions for the construction of C-C bonds

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Photo-induced transformations have been at the forefront of chemical research for many years, yet lately they have received enormous interest. The basis for modern photocatalytic methodologies is set on the transmission of photons to a specific molecule - a photosensitizer, which can be parlayed into the population of the molecule's excited state. This energy can then be transferred to other substrates via energy or electron transfer, wherein the pairing of excited-state energies and of redox potentials, respectively, of the sensitizer and the reactive substrate is crucial for a successful outcome in photochemical reactions. Very recently, our group has started a new research line concerning the use of photochemistry for different reactions, such as thiol-ene/oxidation tandem reactions, asymmetric alkylation of aldehydes² and ring opening cyclopropane expansions. More recently, we have found that the rupture of C-O bonds is possible and can be used for further transformations.¹

In the second part of this talk, I will present an approach for the asymmetric synthesis of tricyclic compounds, via desymmetrization of cyclohexadienones under aminocatalytic conditions. Then, the use of bifunctional catalytic systems for the activation of silyl-dienol ethers for the synthesis of Rauhut-Currier type products will be presented or the use of different organocatalytic intramolecular activation with hydroxyl groups for the synthesis of pyrrolidines and aminoacids will be also shown.² At the end of the talk, we will describe some of our contributions in the field of catalytic materials.³

¹ For some representative works of our group in the photocatalytic field, see: a) Rigotti, T. *et al. ACS-Catalysis*, **2018**, *8*, 5928; b) Luis-Barrera, J. *et al. Angew. Chem. Int. Ed.* **2017**, *56*, 7826; c) Rigotti *et al. ACS Catal.* **2020**, *10*, 5335; Martínez-Gualda, *et al. Nature Communications*, **2019**, *10*, 2634, c) Rodríguez *et al. Angew. Chem. Int. Ed.* **2021**, *23*, 4555; d) Cabrera *et al. Green Chemistry*, **2020**, *22*, 6792.

² Works in the organocatalysis área: a) Martín-Santos *et al. Angew. Chem. Int. Ed.* **2014**, *53*, 8184; b) Frias *et al. J. Am. Chem. Soc.* **2017**, *139*, 672; c) Esteban *et al. ACS-Catalysis*, **2018**, *8*, 1884; b) Guerrero-Corella *et al. Angew. Chem. Int. Ed.* **2018**, *57*, 5350; d) Guerrero-Corella *et al. Chem. Sci.* **2019**, *10*, 4346.

³ Publications dealing with catalytic materials: a) López-Calixto *et al. Appl. Catal. B Environ.* **2019**, *258*, 117933; b) González-Muñoz *et al. J. Catal.* **2019**, *373*, 374; c) Broto-Ribaset *et al. Nanoresearch*, **2021**, 12274; c) Ruiz del Árbol *et al. Angew. Chem. Int. Ed.* **2020**, *5*, 23220; d) González-Muñoz *et al. ACS Applied Materials & Interfaces* **2021**, in press.



José Alemán is Professor of Chemistry at Universidad Autónoma de Madrid (UAM) and Scientific Director of the Institute of Advanced Research in Chemical Sciences at UAM. He received his BSc. in chemistry from the UAM (Spain) (1995-2000) and his PhD. in 2005 with the highest qualification ("Summa Cum Laude"). Furthermore, he was awarded the Lilly Research Award in 2005 as the best chemistry PhD. student in Spain and was also awarded for carrying out the best PhD. thesis at the UAM in 2005/2006. Then, he obtained a two-year

<https://iadchem.uam.es/?staff=864> postdoctoral grant from the Spanish Ministry of Science and carried out a post-doctoral stay in **Denmark** (2006-2008), working in the area of **organocatalysis**. In 2009, he moved to the Organic Chemistry Department at the Universidad Autónoma de Madrid with a "Juan de la Cierva" contract (selected number one in chemistry in 2009). In 2010, he has been a **Ramón y Cajal researcher** (selected number one in chemistry), the most prestigious research position for young scientists in Spain. In 2016, he was promoted to Associate Professor in UAM. During this period, the applicant opened new research lines concerning organocatalysis, photocatalysis and catalytic materials (see www.uam.es/jose.aleman). He has published 160 scientific works, has been invited to give several external talks (>85). He received a **Consolidator Grant** awarded by the European Research Council in 2015 and in 2019 an ERC-Proof of Concept grant.

Most relevant publications and level of authorship: He is currently author of 160 publications in peer-reviewed journals and 6 book chapters. Highlights include: 14 *Angewandte Chemie*, 5 *Journal of American Chemical Society*, 1 *Chemical Science*, 1 *Nature Communications*, 3 *ACS-Catalysis*, 2 *Green Chemistry*, 2 *Applied Environmental B*, 17 *Chemistry A European Journal*, 15 *Organic Letters*, 17 *Chemical Communications*, 2 *Green Chemistry*, 3 *ChemCatChem*, 4 *Adv. Synth. Cat.*, 8 *Journal of Organic Chemistry*, 3 *Dalton Transactions*, 7 chapters in books (Wiley and Thieme), among others. **Patents.** The applicant and has two international and one national patents: one for the synthesis of *trans*-Pt(II) complexes with sulfonamides and the other in collaboration with Sanofi-Aventis for Pt(IV) complexes. Since his first article (2003), the applicant has published in the best-quality journals (92% in Q1 and 72% in D1) with more than 5000 citations and has h impact factor = 37.

Supervisor and academic experience. He has currently run a group of 30 people and during the last 5 years, the group has been financed with 10 projects regarding the field of catalysis. He has mentored 15 master's theses, 20 postdoctoral researchers and 10 PhD. thesis at the UAM. He is currently supervising 14 PhD. theses at the UAM, several assistant professors and 4 postdoctoral students. He has also teaching experience in various subjects at the Organic Chemistry Department (UAM, 2000-2005 and 2009-2019) in bachelor's and master's level classes. He is also a scientific project evaluator for the Spanish National Agency of Science (ANECA), Czech Science Foundation, 'Agencia Nacional de Promoción Científica y Tecnológica' (ANPCyT) of Argentina, European Research Council, UK research agency, and France National Agency of Science (L'Agence Nationale de la Recherche). In addition, he is reviewer for a number of scientific journals (Wiley, RSC, Elsevier....). José Alemán has received different prizes such as Lilly Research Award in 2005 as the best chemistry PhD. student in Spain, best PhD. thesis at the Universidad Autónoma de Madrid in 2005/2006, Sigma-Aldrich prize for youth researchers from "Real Sociedad de Química Española" in 2013 (see *Angew. Chem. Int. Ed.* **2013**, *52*, 11454) or the Lilly Youth Researcher Prize in 2015. He is

member of the *Red de Excelencia en Catálisis Asimétrica* (<http://www.redcasi.es/red-casi-3/>) and also *Red-Orfeo* (<https://orfeocinqa.es/>).