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CiQUS Lecture

**Exploring Photo-
and Electro-catalysis for
Sustainable Synthesis****May 23, 2025**

CiQUS Seminar Room | 09:30 AM

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Abstract

Our research group, FRONCAT (www.uam.es/jose.aleman), aims to utilize green synthetic methodologies for the synthesis of molecules of relevant interest. In this regard, 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. Our research group has mainly focused in recent times on the development of new photocatalytic reactions,^[1] emphasizing primarily the search for more sustainable alternatives, among which the use of flow chemistry is included.^[2] In addition, we will show the most recent works in the field of organocatalysis^[3] and electrochemistry.^[4]

[1] a) J. Luis-Barrera, V. Laina-Martín, T. Rigotti, F. Peccati, X. Solans-Monfort, M. Sodupe, R. Mas-Ballesté, M. Liras, J. Alemán, *Angew. Chem. Int. Ed.* 2017, 56, 7826; b) María Martínez-Gualda, R. Cano, L. Marzo, R. Pérez-Ruiz, J. Luis-Barrera, R. Mas-Ballesté, A. Fraile, V. A. de la Peña O'Shea, and J. Alemán *Nature Commun.* 2019, 10, 2634; c) Rigotti, T.; Mas-Ballesté, R.; Alemán, J. *Enantioselective ACS Catal.* 2020, 10, 5335.; d) Rodríguez, R.; Mollari, L.; Alemán, J. *Angew. Chem. Int. Ed.* 2021, 23, 4555.

[2] a) Jesús Cabrera, M.; Cembellín, S.; Halima-Salem, A.; Berton, M.; Marzo, L.; Miloudi, A.; Maestro, M. C.; Alemán, J. *Green Chem.* 2020, 22, 6792; b) Rodríguez, R.; Sicignano, M.; García, M. J.; Enríquez, R. G.; Cabrera, S.; Alemán, J. *Green Chem.* 2022, 24, 6613. c) Mollari, L.; del Río-Rodríguez, R.; Fernández-Salas, J. A.; Alemán, J. *Green Chem.* 2023, 25, 8510.

[3] a) Rodríguez, R.; Sicignano, M.; Alemán, J. *Angew. Chem. Int. Ed.* 2022, e20211263; b) Alemán, J.; Humbrías-Martín, J.; del Río-Rodríguez, R.; Aguilar-Galindo, F.; Díaz-Tendero, S.; Fernández-Salas, J. A. *Nat. Commun.* 2024, 15, 4727.

[4] A) MacLean, I.; García, M. J.; Cabrera, S.; Marzo, L.; Alemán, J. *Green Chem.* 2024, 26, 6553-6558. b) del Río-Rodríguez, R.; Frago-Jarillo, L.; Garrido-Castro, A.F.; Maestro, M.C.; Fernández-Salas, J.A. Alemán, J. *Chem. Sci.* 2022, 13, 6512-6518

Biosketch

José Alemán defended his Doctoral Thesis in 2006 in the field of asymmetric synthesis under the supervision of Prof. García Ruano. After completing a postdoctoral stay with Prof. Jørgensen (2006-2008) in the field of organocatalysis, he joined the Department of Organic Chemistry at UAM as a Ramón y Cajal researcher and was later promoted to Associate Professor and Full Professor in 2023. He has been awarded various research prizes, such as the Lilly Prize for the best doctoral student (2005), the award for the best Doctoral Thesis at UAM (2006), the Sigma-Aldrich Award for Young Researchers of the RSEQ (2013), the Lilly Young Researcher Award (2015), and the José Barluenga-RSEQ Medal (2022).

His research focuses mainly on asymmetric catalysis and catalytic materials, and he is the author of 220 scientific publications. He has supervised 25 Doctoral Theses, more than 40 Bachelor's and Master's theses, and has secured 18 projects in various competitive calls. Since 2021, he has been the Director of the Advanced Institute of Chemical Sciences-Universidad Autónoma de Madrid; in 2022, he was appointed Deputy Director of the Department of Organic Chemistry, and since 2024, he is Vice President of the Organic Chemistry section of the Spanish Royal Chemistry Society..