

## Dr Virginia Montiel-Palma

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Inorganic / Coordination / Organometallic / Catalysis  
Ligands for transition metal complexation and catalysis  
Activation of small molecules



*My long-term research program is to develop rationally designed organometallic complexes as highly selective catalysts and materials for central processes, many of them are relevant for the chemical industry. Several such processes involve C-H bond activation and functionalization.*

*In the last years, my research group has focused in the study of the coordination chemistry of transition metals bonded to dual functionality silyl, germyl or stanyl-phosphine ligands. Group 14 derivatives are exceptionally good sigma donors and exert a considerably high trans influence/effect, thus upon coordination they usually generate electron rich metal centers, which are in turn capable of activating otherwise inert substrates. Our current efforts involve the development of new materials as catalysts bearing our home-made ligands for model C-H functionalization reactions including alkene hydrosilylation, dehydrogenative silylation, borylation, hydrogenation, etc. Moreover, we have now been able to install some of our reactive organometallic species into Metal Organic Framework, MOFs, as solid substrates, opening an avenue to heterogeneous catalysis and new materials for diverse applications.*

*For some years, our group has also been interested in the chemistry of heterometallic complexes bearing a transition metal center and a group 13 metal (Al, Ga, In). The inclusion of a Lewis acid has led to remarkable reactivity in otherwise difficult transformations including nitrogen extrusion from aromatic molecules.*

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## A. PROFESSIONAL PREPARATION

INSTITUTION	LOCATION	MAJOR/AREA OF STUDY	DEGREE	YEAR
National Autonomous University of Mexico	Mexico City, Mexico	Chemistry	B.Sc. (Hon.)	1992-1996
University of York	York, England, UK	Organometallic Chemistry	D. Phil.	1996-2000
Laboratory of Coordination Chemistry (LCC) - French National Research Center (CNRS)	Toulouse, France	Coordination Chemistry & Catalysis	Postdoctoral fellow	2001

## B. APPOINTMENTS

- 2018 – Assistant Professor, Mississippi State University, Mississippi State, MS
- 2015 - 2018 Professor of Chemistry Level 2, Autonomous University of the State of Morelos (UAEM), Cuernavaca, Morelos
- 2011 - 2012 Visiting Professor, University of Toulouse III, Toulouse, France (sabbatical)
- 2009 - 2015 Professor of Chemistry Level 1, UAEM, Cuernavaca, Morelos
- 2006 - 2009 Assistant Professor Level 3, UAEM, Cuernavaca, Morelos
- 2003 - 2006 Assistant Professor Level 2, UAEM, Cuernavaca, Morelos
- 2002 - 2003 Associate Researcher, COMEX-PPG Chemical Ind., Tepexpan, Mex
- 2001 - 2001 Postdoctoral Associate, LCC du CNRS, Toulouse, France
- 1996 - 2000 Research/Teaching Assistant, University of York, Yorkshire, England, UK
- 1995- 1996 Teaching Assistant, National Autonomous University of Mexico, Mexico

## C. PRODUCTS

### Book Chapters

2. Zamora-Moreno, J.; **Montiel-Palma, V.** "Semirigid pincer-like *SiPSi* ligands: classical versus non classical coordination modes at *Ru, Rh, Ir* and *Pt*" in *Pincer Compounds: Chemistry and Applications* (ISBN 9780128129319). Elsevier. (Book chapter). 2018. *Published*.

1. Zamora-Moreno, J.; **Montiel-Palma, V.** "Versatile Silylphosphine Ligands for Transition Metal Complexation" in *Ligand* (ISBN 978-953-51-5665-9). InTech Open. (Book chapter). 2018. *Published*.

### Journal Articles

38. Gorla, S.; Díaz, M.; Abeynayake, N. S.; Kaphan, D. M.; Williams, D.; Martis, V.; Lara-García, H.; Donnadieu, B.; Lopez, N.; Ibarra, I.; **Montiel-Palma, V.** "Functionalized NU-1000 with an Iridium Organometallic Fragment: SO<sub>2</sub> Capture Enhancement". *ACS Appl. Mat. Interfaces* **2020**. DOI: 10.1021/acsami.0c11615.

37. Salazar-Díaz, J. J.; Muñoz-Hernández, M. A.; Rufino-Felipe, E.; Flores-Alamo, M.; Ramírez-Solís, A.; **Montiel-Palma, V.** "Bi- and Tridentate Stannylphosphines and their Coordination to Low-Valent Platinum". *Dalton Trans.* **2019**, 48, 15896-15905, DOI: 10.1039/C9DT03317C.

36. Cuevas-Chávez, C., Vendier, L.; Sabo-Etienne, S.; **Montiel-Palma, V.** "Iridium complexes featuring a tridentate *SiPSi* ligand: from dimeric to monomeric 14, 16 or 18-electron species". *Dalton Trans.* **2019**, **48**, 14010 – 14018. DOI: 10.1039/C9DT03136G.

35. Corona-Gonzalez, M. V.; Zamora-Moreno, J.; Muñoz-Hernandez, M. A.; Vendier, L.; Sabo-Etienne, S.; **Montiel-Palma, V.** "Exploiting the Versatility of Phosphinobenzylsilanes for the Stabilization of 14-Electron Rhodium(III) and Iridium(III) Complexes". *Eur. J. Inorg. Chem.* **2019**, 1854–1858. DOI:10.1002/ejic.201900107.

33. Zamora-Moreno, J.; Murillo, F.; Muñoz-Hernández, M. A.; Grellier, M.; Pan, S.; Jalife, S.; Merino, G.; Sabo-Etienne, S.; **Montiel-Palma, V.** "Modulation of an Anagostic Interaction in *SiPSi*-Type Pincer Platinum Complexes". *Organometallics* **2018**, **37**, 3581–3587. DOI: 10.1021/acs.organomet.8b00269.

32. Durango-García, C. J.; Rufino-Felipe, E.; López-Cardoso, M.; Muñoz-Hernández, M. A. and **Montiel-Palma, V.** "Lithium, sodium and potassium complexes supported by a tridentate amino-bisphenolate ligand: synthesis and structural characterization". *J. Mol. Struct.* **2018**, **1164**, 248-258. DOI: 10.1016/j.molstruc.2018.03.079.

31. De la Cruz-Burelo, P.; Caballero-Jiménez, J.; Montiel-Palma, V.; Muñoz-Hernández, M.-Á. "Alkyl Al, Ga and Zn thiocarbamatephenol complexes: synthesis, characterization and activity as Diels Alder catalysts". *Inorg. Chim. Acta* **2018**, *473*, 236-244. DOI: 10.1016/j.ica.2017.12.031
30. Rufino-Felipe, E.; Muñoz-Hernández, M. A., **Montiel-Palma, V.** "Lithium Complexes Derived of Benzylphosphines: Synthesis, Characterization and Evaluation in the ROP of *rac*-Lactide and  $\epsilon$ -Caprolactone". *Molecules* **2018**, *23*(1), 82; DOI:10.3390/molecules23010082
29. Cuevas-Chávez, C. A.; Zamora-Moreno, J.; Muñoz-Hernández, M. A.; Bijani, C.; Sabo-Etienne, S.; **Montiel-Palma, V.** "Stabilization of *Trans* Disilyl Coordination at Square Planar Platinum Complexes". *Organometallics* **2018**, *37*, 720-728. DOI: 10.1021/acs.organomet.7b00566.
28. Corona-González, M. V.; Zamora-Moreno, J.; Cuevas-Chávez, C. A.; Rufino-Felipe, E.; Mothes-Martin, E.; Coppel, Y.; Muñoz-Hernández, M. A.; Vendier, L.; Flores-Alamo, M.; Grellier, M.; Sabo-Etienne, S.; **Montiel-Palma, V.** A Family of Rhodium and Iridium Complexes with Semirigid Benzylsilyl Phosphines: From Bidentate to Tetradentate Coordination Modes. *Dalton Trans.* **2017**, *46* (27), 8827–8838 DOI: 10.1039/C7DT00727B
27. Durango-García, C. J.; Jalife, S.; Cabellos, J. L.; Martínez, S. H.; Jimenez-Halla, J. O. C.; Pan, S.; Merino, G.; **Montiel-Palma, V.** Back to Basics: Identification of Reaction Intermediates in the Mechanism of a Classic Ligand Substitution Reaction on Vaska's Complex. *RSC Adv.* **2016**, *6* (4), 3386–3392. DOI:10.1039/C5RA20969B
26. Ramírez-Meneses, E.; **Montiel-Palma, V.**; Dominguez-Crespo, M. A.; Izaguirre-López, M. G.; Palacios-Gonzalez, E.; Dorantes-Rosales, H. Shape-and Size-Controlled Ag Nanoparticles Stabilized by in Situ Generated Secondary Amines. *J. Alloys Compd.* **2015**, *643*, S51–S61. DOI: 10.1016/j.jallcom.2015.01.035
25. Smart, K. A.; Grellier, M.; Coppel, Y.; Vendier, L.; Mason, S. A.; Capelli, S. C.; Albinati, A.; **Montiel-Palma, V.**; Muñoz-Hernández, M. A.; Sabo-Etienne, S. Nature of Si–H Interactions in a Series of Ruthenium Silazane Complexes Using Multinuclear Solid-State NMR and Neutron Diffraction. *Inorg. Chem.* **2014**, *53* (2), 1156–1165. DOI: 10.1021/ic4027199
24. **Montiel-Palma, V.**; Muñoz-Hernández, M. A.; Cuevas-Chávez, C. A.; Vendier, L.; Grellier, M.; Sabo-Etienne, S. Phosphinodi (Benzylsilane) PhP  $\{(o\text{-C}_6\text{H}_4\text{CH}_2)\text{SiMe}_2\text{H}\}_2$ : A Versatile "PSi<sub>2</sub>H X" Pincer-Type Ligand at Ruthenium. *Inorg. Chem.* **2013**, *52* (17), 9798–9806. DOI: 10.1021/ic400703r
23. Ramírez-Meneses, E.; **Montiel-Palma, V.**; Chávez-Herrera, V. H.; Reyes-Gasga, J. Decoration of Single-Walled Carbon Nanotubes with Pt Nanoparticles from an Organometallic Precursor. *J. Mater. Sci.* **2011**, *46* (10), 3597–3603. DOI: 10.1007/s10853-011-5275-4
22. Ramírez-Meneses, E.; Betancourt, I.; Morales, F.; **Montiel-Palma, V.**; Villanueva-Alvarado, C. C.; Hernández-Rojas, M. E. Superparamagnetic Nickel Nanoparticles

Obtained by an Organometallic Approach. *J. Nanoparticle Res.* **2011**, *13* (1), 365–374. DOI: 10.1007/s11051-010-0039-7.

21. Gaggero-Sager, L. M.; Naumis, G. G.; Muñoz-Hernandez, M. A.; Montiel-Palma, V. Self-Consistent Calculation of Transport Properties in Si  $\delta$ -Doped GaAs Quantum Wells as a Function of the Temperature. *Phys. B Condens. Matter* **2010**, *405* (20), 4267–4270. DOI: 10.1016/j.physb.2010.07.022 PDF

20. Durango-García, C. J.; Jiménez-Halla, J. O. C.; López-Cardoso, M.; **Montiel-Palma, V.**; Muñoz-Hernández, M. A.; Merino, G. On the Nature of the Transition Metal–main Group Metal Bond: Synthesis and Theoretical Calculations on Iridium Gallyl Complexes. *Dalton Trans.* **2010**, *39* (44), 10588–10589. DOI: 10.1039/C0DT01071E

19. Tiempos-Flores, N.; Metta-Magaña, A.-J.; **Montiel-Palma, V.**; Cortés-Llamas, S.-A.; Muñoz-Hernández, M.-Á. Aluminium Complexes Derived from Tridentate Thioetherbis (Phenolate) Ligands and Their Activity in Diels–Alder Catalysis. *Dalton Trans.* **2010**, *39* (18), 4312–4320. DOI: 10.1039/B922657E

18. Ramírez-Meneses, E.; Dominguez-Crespo, M. A.; **Montiel-Palma, V.**; Chávez-Herrera, V. H.; Gomez, E.; Hernández-Tapia, G. Electrochemical Characterization of Platinum Nanoparticles Stabilized by Amines. *J. Alloys Compd.* **2009**, *483* (1), 573–577. DOI: 10.1016/j.jallcom.2008.08.141

17. Dominguez-Crespo, M. A.; Ramírez-Meneses, E.; **Montiel-Palma, V.**; Huerta, A. M. T.; Rosales, H. D. Synthesis and Electrochemical Characterization of Stabilized Nickel Nanoparticles. *Int. J. Hydrogen Energy* **2009**, *34* (4), 1664–1676. DOI: 10.1016/j.ijhydene.2008.12.012

16. Velázquez-Carmona, M.-Á.; Metta-Magaña, A.-J.; Cortés-Llamas, S.-A.; **Montiel-Palma, V.**; Muñoz-Hernández, M.-Á. Potassium and Lithium Pyrazolates: The Interplay of Electronic and Steric Factors on the Hapticity of the Pyrazolate Ligand and the Influence of Lewis Bases on Nuclearity. *Polyhedron* **2009**, *28* (2), 205–208. DOI: 10.1016/j.poly.2008.10.041

15. Muñoz-Hernández, M.-Á.; **Montiel-Palma, V.** Polypyrazolates of the Heavier Group 13 and 14 Elements: A Review. *Inorg. Chim. Acta* **2009**, *362* (12), 4328–4339. DOI: 10.1016/j.ica.2009.06.051

14. **Montiel-Palma, V.**; Piechaczyk, O.; Picot, A.; Auffrant, A.; Vendier, L.; Le Floch, P.; Sabo-Etienne, S. Bonding Mode of a Bifunctional P~ Si– H Ligand in the Ruthenium Complex “Ru(PPh<sub>2</sub>CH<sub>2</sub>OSiMe<sub>2</sub>H)<sub>3</sub>.” *Inorg. Chem.* **2008**, *47* (19), 8601–8603. DOI: 10.1021/ic801327a

13. Valerio Cardenas, C.; **Montiel Palma, V.**; Muñoz Hernandez, M.-A.; Grevy, J.-M. Synthesis and Conformational Study in Solution and Solid State of 1, 3-Dioxa-6-Aza-2 (O-Trimethylsilylester)-and 1, 3-Dioxa-6-Aza-2 (Hydroxy)-Sigma (4) Lambda (4) Phosphacyclooctanes. *Arkivoc* **2008**, 153–171.

12. **Montiel-Palma, V.**; Muñoz-Hernández, M. A.; Ayed, T.; Barthelat, J.-C.; Grellier, M.; Vendier, L.; Sabo-Etienne, S. Agostic Si–H Bond Coordination Assists C–H Bond

Activation at Ruthenium in Bis (Phosphinobenzylsilane) Complexes. *Chem. Commun.* **2007**, 38, 3963–3965. DOI: 10.1039/B709408F

11. De La Cruz-Burelo, P.; **Montiel-Palma, V.**; Muñoz-Hernández, M.-Á. Organogallium Complexes Incorporating Tridentate Thioetherbiphenolate Ligands 2, 2'-Thiobis (4, 6-Di-Tert-Butylphenolate), Stdiol and 2, 2'-Thiobis (4, 6-Dimethylphenolate), Smdiol. *Main Gr. Chem.* **2006**, 5 (1), 61–77. DOI: 10.1080/10241220600903514

10. Lachaize, S.; Essalah, K.; **Montiel-Palma, V.**; Vendier, L.; Chaudret, B.; Barthelat, J.-C.; Sabo-Etienne, S. Coordination Modes of Boranes in Polyhydride Ruthenium Complexes:  $\sigma$ -Borane versus Dihydroborate. *Organometallics* **2005**, 24 (12), 2935–2943. DOI: 10.1021/om050276l

9. Muñoz-Hernández, M.-Á.; **Montiel-Palma, V.**; Huitrón-Rattinger, E.; Cortés-Llamas, S.; Tiempos-Flores, N.; Grevy, J.-M.; Silvestru, C.; Power, P. Dichloro and Alkylchloro Gallium Derivatives of Dichalcogenoimidodiphosphinate Ligands: Isolation of a Spirogallium Cation. *Dalton Trans.* **2005**, No. 1, 193–199. DOI: 10.1039/B412874E

8. **Montiel-Palma, V.**; Pattison, D. I.; Perutz, R. N.; Turner, C. Photochemistry of Ru (etp)(CO) H<sub>2</sub> (etp= PhP (CH<sub>2</sub>CH<sub>2</sub>PPh<sub>2</sub>)<sub>2</sub>): Fast Oxidative Addition and Coordination Following Exclusive Dihydrogen Loss. *Organometallics* **2004**, 23 (17), 4034–4039. DOI: 10.1021/om049729x.

7. **Montiel-Palma, V.**; Huitrón-Rattinger, E.; Cortés-Llamas, S.; Muñoz-Hernández, M.; García-Montalvo, V.; López-Honorato, E.; Silvestru, C. Towards Cationic Gallium Derivatives: Metallacycles from the Reactions of Organogallium Compounds with Tetraorganodichalcogenoimidodiphosphinates and a New N-(Diphenylthiophosphinyl) Thioureato Ligand. *Eur. J. Inorg. Chem.* **2004**, 2004 (18), 3743–3750. DOI: 10.1002/ejic.200400087

6. Essalah, K.; Barthelat, J.-C.; **Montiel, V.**; Lachaize, S.; Donnadiu, B.; Chaudret, B.; Sabo-Etienne, S. 9-BBN activation. Synthesis, crystal structure and theoretical characterization of the ruthenium complex Ru[( $\eta^5$ -H)<sub>2</sub>BC<sub>8</sub>H<sub>14</sub>]<sub>2</sub>(PCy<sub>3</sub>). *J. Organomet. Chem.* **2003**, 680, 182-187. DOI : 10.1016/S0022-328X(03)00343-7

5. **Montiel-Palma, V.**; Lumbierres, M.; Donnadiu, B.; Sabo-Etienne, S.; Chaudret, B.  $\sigma$ -Borane and Dihydroborate Complexes of Ruthenium. *J. Am. Chem. Soc.* **2002**, 124(20), 5624–5625. DOI: 10.1021/ja017429q.

4. Heenan, D. P.; Long, C.; **Montiel-Palma, V.**; Perutz, R. N.; Pryce, M. T. Photochemistry of ( $\eta^5$ -C<sub>5</sub>H<sub>5</sub>)( $\eta^5$ -C<sub>4</sub>H<sub>4</sub>N)Fe and ( $\eta^5$ -C<sub>5</sub>H<sub>5</sub>)( $\eta^1$ -N-C<sub>4</sub>H<sub>4</sub>N)Fe(CO)<sub>2</sub> in Low-Temperature Matrixes and Room-Temperature Solution. Evidence for a Photoinduced Haptotropic Shift of the  $\pi$ -Coordinated Pyrrolyl Ligand. *Organometallics* **2000**, 19 (19), 3867–3873. DOI: 10.1021/om0002632.

3. **Montiel-Palma, V.**; Perutz, R. N.; George, M. W.; Jina, O. S.; Sabo-Etienne, S. Two Photochemical Pathways in Competition: Matrix Isolation, Time-Resolved and NMR

Studies of Cis-[Ru (PMe<sub>3</sub>)<sub>4</sub>(H)<sub>2</sub>] *Chem. Commun.* **2000**, 13, 1175–1176. DOI: 10.1039/B002297G

2. Garcia, J. J.; Arevalo, A.; Capella, S.; Chehata, A.; Hernandez, M.; **Montiel, V.**; Picazo, G.; Del Rio, F.; Toscano, R. A.; Adams, H. Analysis of a Hydrodesulfurization process—2 [1]. The Reactions of 2-and 3-Methylthiophenes with Tris (Triethylphosphine) Platinum(0). *Polyhedron* **1997**, 16 (18), 3185–3195. DOI:10.1016/S0277-5387(97)00021-1

1. Garcia, J. J.; Arevalo, A.; **Montiel, V.**; Del Rio, F.; Quiroz, B.; Adams, H.; Maitlis, P. M. Analysis of a Hydrodesulfurization Process. 3. Acid Cleavage of Thiaplatinacycles 1. *Organometallics* **1997**, 16 (14), 3216–3220. DOI: 10.1021/om9701985.

### **In extense memoirs**

2. Garcia-Murillo, A.; Ramírez-Meneses, E.; Ramírez-Salgado, J.; Sandoval-Robles, B. G.; **Montiel-Palma, V.**; Dorantes-Rosales, H.; Del Angel-Vicente, P. Structure of Ni nanoparticles/TiO<sub>2</sub> Films Prepared by Sol-Gel Dip-Coating. *NSTI Nanotech* **2008**, 748-751. *In extense memoir.*

1. Ramírez-Meses, E.; Domínguez -Crespo, M. A.; Dorantes-Rosales, H.; Torres-Huerta, A. M.; **Montiel-Palma, V.**; Hernández Tapia, G. Synthesis and electrochemical characterization of sponge-like nickel nanoparticles”. *NSTI Nanotech* **2008**, 981-984. *In extense memoir.*

## **D. SYNERGISTIC ACTIVITIES**

### **Broader impact activities**

(2020-) Mississippi Migrant Education Service Center, MMESC, Mississippi. “Learn Science with Dr. Montiel” (“Aprenda Ciencia con la Dra. Montiel”) series. Zoom lectures and activities for students in grades 6-12 enrolled in the MMESC.

(2013-2015) Chemistry Graduate Coordinator, UAEM, Cuernavaca, Mexico. Contributed towards the creation of new M. Sc. and Ph.D. programs (UAEM) and their public funding (> 50 postgraduate full scholarships for students).

(2011-2018) Speaker/Demonstrator, “Science is Fun!” series, several elementary, middle and high schools in Cuernavaca, Morelos, Mexico. Conducted interactive sessions for K-12 students on Chemistry and Science.

## **D. LECTURES DELIVERED (LAST 5 YEARS)**

**ACS National Meeting Fall 2020** – Virtual Meeting. Symposium “Advancing Frontiers in Heterometallic Chemistry”. August 17-20, 2020. (Invited speaker)

**Latin American Symposium on Coordination and Organometallic Chemistry, SILQCOM**, Cartagena, Colombia, August 2019. (Invited speaker)

**Millsaps College**, Jackson, MS. November 2018.

**Southeastern Louisiana University**, Hamilton, LA, October 2018.

**International Conference on Polymers and Advanced Materials, POLYMAT**, Huatulco, Mexico, October 2017. (Invited speaker)

**100<sup>th</sup> Canadian Chemistry Conference and Exhibition**. Toronto, Canada, June 2017.

**Inorganic Chemistry Meeting “Encuentro Química Inorgánica EQI 2015”**, Saltillo, Mexico, September 2015.

**International Conference on Polymers and Advanced Materials, POLYMAT**, Huatulco, Mexico, October 2015.

## **E. STUDENT SUPERVISION**

Former advisor of 11 BSc and 15 graduate students: 10 MSc and 5 PhD students.

Currently supervising 2 undergraduate and 3 PhD students at MSU and a postdoctoral fellow.

Numerous thesis advisory panels and examination committees.

## **F. FUNDED GRANTS**

- Mexican Research Council – French Research Agency (CONACyT-ANR, Project 274001 “N<sub>2</sub>CDFun- New complexes for catalysis”. Awarded 2,510,558 MXP, approximately equivalent to \$167,370). 2016-2018.
- Mexican Research Council “Basic Science” (CONACyT, Project 242818, “Synthesis of complexes derived of late transition metals and group 14 derivatives”. Awarded 1,999,843 MXP, then approximately equivalent to \$133,333). 2015-2018
- Mexican Research Council “Basic Science” (CONACyT, Project 105762 “Heterobimetallic transition metal-main group metal complexes”. Awarded 1,730,234 MXP, then equivalent approximately to \$133,094) 2010-2015



- Mexican Research Council “Basic Science” (CONACYT, Project 43540 “Chemistry of transition metal complexes containing M-B and M-Si bonds”. Awarded 1,000,000 MXN, then equivalent approximately to \$83,333) 2005-2009.

#### **G. LANGUAGES**

Spanish – Native or Bilingual proficiency

English – Full Professional Proficiency

French – Minimum Professional Proficiency