

Dr. Ganesan Mani

Department of Chemistry

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Web site: <https://sites.google.com/view/organometallics-lab/home>; Cell: 9434745674

Research Area: Organometallic and Main Group compounds bearing novel pincer and NHC ligands for different types of catalysis

Professional Degrees and Research Experience

- Jan. 2020 Professor, Department of Chemistry, IIT-Kharagpur. India.
- 2013 – Dec. 2019 Associate Professor, Department of Chemistry, IIT-Kharagpur. India.
- 2007 - 2013 Assistant Professor, Department of Chemistry, IIT-Kharagpur. India.
- 2006 - 2007 Senior Scientist, Nanoco Technologies Ltd. Manchester, U. K.;
- Quantum dots syntheses and characterizations.
- 2004 - 2006 Postdoctoral Fellow, Western Michigan University, U.S.A;
- Mentor: Prof. S. Obare, Metal nanoparticles synthesis and applications.
- 2002 - 2004 Postdoctoral Fellow, Texas A&M University, College Station, U.S.A;
- Mentor: Prof. F. P. Gabbai, Olefin polymerization and Main Group Chemistry.
- 2000 - 2002 Postdoctoral Fellow, Purdue University, West Lafayette, U.S.A;
- Mentor: Prof. R. A. Walton, Multiple bonded Re-Re compounds.
- 1999 - 2000 Postdoctoral Fellow, University of Ottawa, Ottawa, Canada;
- Mentor: Prof. S. Gambarotta, Lanthanides and early transition metals.
- 1992 - 1999 Ph. D. Advisor: Prof.. S. S. Krishnamurthy. Indian Institute of Science, Bangalore.
- 1990 - 1992 M. Sc., Chemistry, I-Class, Dept. of Chem., Bharathidasan University, India.
- 1987 - 1990 B. Sc., Chemistry, I-Class with distinction, A. V. C. College, Mayiladuthurai, India.

No. of Ph.D. students completed solely under my guidance: 11

No. of publications: 54

No. of patent: 2

No. of book chapter: 1

Publication List

54. Kumar, A.; Gupta, R.; and Mani, G. PCP Pincer Carbene Nickel(II) Chloride, Hydride, and Thiolate Complexes: Hydrosilylation of Aldehyde, Ketone, and Nitroarene by the Thiolate Complex, *Organometallics* **2023**, *42*, 732–744.

53. D. Panigrahi, M. Mondal, and G. Mani, Four- and five-coordinate nickel(II) complexes bearing new diphosphine-phosphonite and triphosphine-phosphite ligands: catalysts for N-alkylation of amines. *RSC Adv.*, **2022**,12, 4510-4520.
52. V. K. Jha, S. Das, V. Subramaniyan, T. Guchhait, K. K. Dakua, S. Mishra, and G. Mani, Synthesis, structural characterization, and bonding analysis of two-coordinate copper(I) and silver(I) complexes of the pyrrole-based bis(phosphinimine): new metal-pyrrole ring π interactions, *Dalton Transactions*, **2021**, 50, 8036-8044.
51. D. Panigrahi, V. Subramaniyan and G. Mani, Synthesis and Structural Characterizations of Pd(II) Complexes Bearing the New Hexahydropyrimidine and Tetrahydropyrimidinium Based Bis(pyrazole) Ligands with DFT Studies, *J. Mol. Struc.*, **2021**, 1231, 129949.
50. R. Kumar, T. Guchhait, V. Subramaniyan, C. Schulzke, and G. Mani, Versatility of the bis(iminopyrrolylmethyl)amine ligand: tautomerism, protonation, helical chirality, and secondary coordination sphere with halogen bonds in the formation of copper(II) and nickel(II) complexes *Dalton Transactions*, **2020**, 49, 13840, DOI: 10.1039/D0DT02964E.
49. V. Subramaniyan A. Kumar G. Mani, New Spiro-borane and Spiro-borate Derived from Dipyrromethane and their H/D Exchange Properties, *Polyhedron*, **2020**, 186, 114612. <https://doi.org/10.1016/j.poly.2020.114612>.
48. S. Das, V. Subramaniyan, M. Mondal and G. Mani, Synthesis, X-Ray Structures, and Fluxional Properties of Symmetrical, Asymmetrical Binuclear and Cubane Type Copper(I) Complexes Bearing the Pyrrole-Based P, N-Hetero Donor Ligand, *ChemistrySelect*, **2020**, 5, 5006-5012. <https://doi.org/10.1002/slct.202001312>
47. Jana, D.; Guchhait, T.; Subramaniyan, V.; Kumar, A.; Mani, G. Mannich Reaction of Pyrrole and Dimethylpyrrole with Monoamines and Diamines, *Tetrahedron Letters*, **2019**, 60, 151247 (I.F: 2.259) doi.org/10.1016/j.tetlet.2019.151247
46. Kumar, R.; Guchhait, T.; Subramaniyan, V.; Mani, G. Mixed Ligand Cu(II) Complexes: Square Pyramidal vs Trigonal Bipyramidal with the Pyrrole-based Dipodal Ligand Having Hydrogen Bond Acceptors, *J. Molecular Structure*, **2019**, 1195, 1-9. (I.F: 2.12).
45. Subramaniyan, V.; Kumar, A.; Govindaraj, A.; Mani, G. Crystal Structure and DFT Analyses of a Penta-coordinated PCP Pincer Nickel(II) Complex. *Acta Cryst.* **2019**, C75, 734–739. (Impact Factor: 0.93)
44. Das, S.; Subramaniyan, V.; Mani, G. Nickel(II) and Palladium(II) Complexes Bearing an Unsymmetrical Pyrrole-based PNN Pincer and their Norbornene Polymerization Behaviors Versus the Symmetrical NNN and PNP Pincers, *Inorg. Chem.*, **2019**, 58, 3444–3456. (Impact Factor: 4.85).
43. Mani, G.; Subramaniyan, V. *Homoleptic and Heteroleptic Copper(I) Complexes Bearing Diimine-Diphosphine Ligands*, Chapter 8 in 'Copper(I) Chemistry of Phosphines,

- Functionalized Phosphines and Phosphorus Heterocycles' Edited by Balakrishna, M. S., Elsevier Publications, **2019**, 237-258.
42. Subramanian, V.; Dutta, B.; Govindaraj, A.; Mani, G. Facile Synthesis of Pd(II) and Ni(II) Pincer Carbene Complexes by the Double C–H Bond Activation of a New Hexahydropyrimidine-Based Bis(phosphine): Catalysis of C–N Couplings, *Dalton Transactions*, **2019**, **48**, 7203 - 7210 (**invited article for the New Talent: Asia Pacific themed issue of Dalton Transactions**) (Impact Factor: 4.099).
 41. Jana, O.; Mani, G. Enantiomers and Structural Isomers of Sodium and Palladium Complexes Bearing *ortho*-Bis(3,5-dimethylpyrazolylmethyl)phenolate: Fluxional Property and Highly Active Catalysts for Norbornene Polymerization. *Inorg. Chem.* **2018**, **57**, 7735-7747.
 40. Kumar, S.; Jana, O.; Subramanian, V.; Mani, G. The 'Reverse Transmetalation' Reaction of the Pyrrole-Based PNP Pincer Ni(II) Complexes: X-ray Structures of Binuclear Silver(I) and Thiocyanate Nickel(II) Complexes. *Inorg. Chim. Acta.* **2018**, **480**, 113.
 39. Subramanian, V.; Mani, G. Synthesis, Reactions, and Structures of Heterocycle-Tethered Boranes and Their Precursors, *Organometallics*, **2018**, **37**, 127–135.
 38. Jana, O.; Mani, G. New types of Cu and Ag clusters supported by the pyrrole-based NNN-pincer type ligand, *New J.Chem.*, **2017**, **41**, 9361-9370.
 37. Jha, V. K.; Mani, G.; Davuluri, Y. R.; Anoop, A. The pyrrole ring η^2 -hapticity bridged binuclear tricarbonyl Mo(0) and W(0) complexes: catalysis of regioselective hydroamination reactions and DFT calculations, *Dalton Trans.*, **2017**, **46**, 1840-1847.
 36. Guchhait, T.; Mani, G.; Schulzke, C. Synthesis and structural characterization of anion complexes with azacalix[2]dipyrrolylmethane: effect of anion charge on the conformation of the macrocycle *Dalton Trans.* **2016**, **45**, 11781 - 11790.
 35. Kumar, R.; Paul, T.; Jana, O.; Mani, G. Regioselective Mannich bases of pyrrole-2-carbaldehyde and binuclear copper(II) complexes of bis(iminopyrrolyl) ligand containing the piperazine ring *Inorg. Chim. Acta.* **2016**, **445**, 70-78.
 34. Kumar, S.; Mani, G. Synthesis and structural characterization of chromium(III) complexes bearing 3,5-dimethylpyrazolate ligand *Polyhedron*, **2015**, **99**, 47-52.
 33. Jana, D.; Das, S.; Mani, G. Self Assembled Macrobicyclic and Tricyclic Cages Containing Pyrrole Rings by Dynamic Covalent Chemistry Method *J. Incl. Phenom. Macrocycl. Chem.* **2015**, **82**, 461-470.
 32. Guchhait, T.; Barua, B.; Biswas, A.; Basak, B.; Mani, G. Synthesis and structural characterization of silver(I), copper(I) coordination polymers and a helicate palladium(II) complex of dipyrrolylmethane-based dipyrazole ligands: the effect of *meso* substituents on structural formation *Dalton Trans.*, **2015**, **44**, 9091-9102.

31. Kumar, R.; Mani, G. Exhibition of the Brønsted acid–base character of a Schiff base in palladium(II) complex formation: lithium complexation, fluxional properties and catalysis of Suzuki reactions in water *Dalton Trans.*, **2015**, 44, 6896–6908.
30. Ghorai, D.; Mani, G. Unsubstituted quinoidal pyrrole and its reaction with oxygen, charge transfer and palladium(II) complexes *via* DDQ oxidation *RSC Adv.*, **2014**, 4, 45603-45611.
29. Ghorai, D.; Mani, G. Single-Step Substitution of all the α , β -Positions in Pyrrole: Choice of Binuclear versus Multinuclear Complex of the Novel Polydentate Ligand *Inorg. Chem.*, **2014**, 53, 4117–4129.
28. Kumar, S.; Mani, G.; Dutta, D.; Mishra, S. Structural Diversity of Copper(I) Complexes Formed by Pyrrole- and Dipyrrolylmethane-Based Diphosphine Ligands with Cu–X $\cdots$ HN Hydrogen Bonds *Inorg. Chem.* **2014**, 53, 700–709.
27. Jana, D.; Mani, G.; Schulzke, C. Synthesis of Novel Polyazacryptands for Recognition of Tetrahedral Oxoanions and Their X-ray Structures *Inorg. Chem.* **2013**, 52, 6427–6439.
26. Guchhait, T.; Jha, V. K.; Mani, G. The *syn* and *anti* isomers of the porphyrinogen-like precursor of calix[4]phyrin: isolation, X-ray structure, anion binding and fluoride-ion-mediated proton–deuterium exchange studies *Org. Biomol. Chem.*, **2013**, 11, 2818-2826.
25. Kumar, S.; Mani, G.; Mondal, S.; Chattaraj, P. K. Pyrrole-Based New Diphosphines: Pd and Ni Complexes Bearing the PNP Pincer Ligand *Inorg. Chem.* **2012**, 51, 12527-12539.
24. Guchhait, T.; Mani, G.; Schulzke, C.; Anoop, A. A Tripyrrolylmethane-Based Macrobicyclic Triazacryptand: X-ray Structure, Size-Selective Anion Binding, and Fluoride-Ion-Mediated Proton–Deuterium Exchange Studies *Inorg. Chem.* **2012**, 51, 11635–11644.
23. Kumar, R.; Guchhait, T.; Mani, G. Synthesis and X-ray Structures of Novel Macrocycles and Macrobicycles Containing *N,N*-Di(pyrrolylmethyl)-*N*-methylamine Moiety: Preliminary Anion Binding Study *Inorg. Chem.* **2012**, 51, 9029–9038.
22. Ghorai, D.; Kumar, S.; Mani, G. Mononuclear, helical binuclear palladium and lithium complexes bearing a new pyrrole-based NNN-pincer ligand: fluxional property *Dalton Trans.* **2012**, 41, 9503-9512.
21. Guchhait, T.; Mani, G. Dipyrrolylmethane-based Macrobicyclic Azacryptand: Synthesis, X-ray Structures, Conformational and Anion Binding Properties *J. Org. Chem.* **2011**, 76, 10114-10121.
20. Ghorai, D.; Mani, G. Synthesis and structural characterization of Pd(II) complexes containing 2,6-bis[(dimethylamino)methyl]-4-methylphenolate ligand *Inorg. Chim. Acta.* **2011**, 372, 412-416.
19. Mani, G.; Guchhait, T.; Kumar, R.; Kumar, S. Macrocyclic and Acyclic Molecules Synthesized from Dipyrrolylmethanes: Receptors for Anions, *Org. Lett.* **2010**, 12, 3910–3213.

18. Mani, G.; Jana, D.; Kumar, R.; Ghorai, D. Azatripyrrolic and Azatetrapyrrolic Macrocycles from the Mannich Reaction of Pyrrole: Receptors for Anions, *Org. Lett.* **2010**, *12*, 3212–3215.

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G. Mani, and S. Kumar, D. Ghorai, T. Guchhait, Pyrrole-based Diphosphines and their Oxidized Products. Intellectual Property India. Patent No. 317093.

17. **Ganesan, M.**; Freemantle, R. G.; Obare, S. O., Monodisperse Thioether- Stabilized Palladium Nanoparticles: Synthesis, Characterization, and Reactivity, *Chem. Mater.*, **2007**, *19*, 3464-3471.
16. **Ganesan, M.**; Gabbai, F.P. Synthesis, structure and catalytic properties of $[\text{Cp}^*\text{Cr}(\text{C}_6\text{F}_5)(\text{Bn})(\text{THF})]$ toward ethylene in the presence of AlEt_3 *J. Organomet. Chem.* **2005**, *690*, 5145-5149.
15. **Ganesan, M.**, Krishnamurthy S.S, Nethaji M., Di- and tri-nuclear molybdenum–palladium complexes bearing strong π -acceptor “P–N–P” ligands, $\text{MeN}\{\text{P}(\text{OR})_2\}_2$ ($\text{R} = \text{CH}_2\text{CF}_3$ or Ph). *J. Organomet. Chem.* **2005**, *690*, 1080-1091.
14. **Ganesan, M.**; Gabbai, F.P. $[\text{Cp}^*\text{Cr}(\text{C}_6\text{F}_5)(\text{Me})(\text{Py})]$ as a Living Chromium(III) Catalyst for the “Aufbaureaktion” *Organometallics*, **2004**, *23*, 4608-4613.
13. **Ganesan, M.**; Gabbai, F.P. A neutral chromium(III) catalyst for the living “Aufbaureaktion” *Angew. Chem. Int. Ed. Engl.* **2004**, *43*, 2263-2266.
12. **Ganesan, M.**; Fanwick, P.E.; Walton, R.A. The synthesis of the triply bonded tetramethyl complex $\text{Re}_2(\text{CH}_3)_4(\mu\text{-dppm})_2$ and its reaction with CO to afford $\text{Re}_2(\mu\text{-CH}_2)_2(\text{CO})_4(\mu\text{-dppm})_2$. *J. Organomet. Chem.* **2003**, *671*, 166-171.
11. **Ganesan, M.**; Fanwick, P.E.; Walton, R.A. Reaction of the bis(iminophosphoranyl)methane ligand $\text{CH}_2(\text{Ph}_2\text{P}=\text{NsiMe}_3)$ with nickel(II) halides and the structural characterization of ligand fragmentation products, *Inorg. Chim. Acta.* **2003**, *346*, 181-186.
10. **Ganesan, M.**; Shih, K.Y.; Fanwick, P.E.; Walton, R.A. Complexation of the triply-bonded dirhenium(II) complex $\text{Re}_2\text{Cl}_4(\mu\text{-dppm})_2$ ($\text{dppm} = \text{Ph}_2\text{PCH}_2\text{PPh}_2$) by up to three acetylene molecules, *Inorg. Chem.* **2003**, *42*, 1241-1247.
9. **Ganesan, M.**; Fanwick, P.E.; Walton, R.A. The synthesis and structural characterization of the μ -sulfur dioxide complex $\text{Re}_2(\mu\text{-SO}_2)(\mu\text{-Cl})\text{Cl}_4(\mu\text{-dppm})_2$, *Inorg. Chim. Acta.* **2003**, *343*, 391-394.
8. **Ganesan, M.**; Fanwick P.E.; Walton R.A. A Novel Example of the Reductive Cyclization of a Diyne at a Re-Re Triple Bond: The Reaction of $\text{Re}_2\text{Cl}_4(\mu\text{-dppm})_2$ with 1,7-Octadiyne, *Organometallics*, **2003**, *22*, 870-872.

7. **Ganesan, M.**; Kapoor P.N.; Fanwick P.E.; Walton R.A. The first examples of triply bonded dirhenium(II) complexes that contain β -diketonate ligands, *Inorg. Chem. Commun.*, **2002**, 5, 1073-1077.
6. **Ganesan, M.**; Bérubé C.D.; Gambarotta S.; Yap G.P.A. Synthesis of Samarium and Ytterbium Complexes with 2,5-Dimethylpyrrole: The Effect of the Alkali Cation on the Bonding Mode of Divalent Lanthanide Centres, *Organometallics*, **2002**, 21, 1707-1713.
5. **Ganesan, M.**; Lalonde M. P.; Gambarotta S.; Yap G.P.A. Isolation and Characterization of Linear Polymeric $\{[1,1\text{-H}_{10}\text{C}_6(\alpha\text{-C}_4\text{H}_3\text{N})_2]\text{Sm}[\text{Na}(\text{THF})]_2\}_n$: A 30-Electron Species with a $(\eta^5\text{-Cp})_4\text{Ln}$ Type Structure, *Organometallics*, **2001**, 20, 2443-2445.
4. **Ganesan, M.**; Gambarotta S.; Yap G.P.A. Highly Reactive Sm(II) Macrocyclic Clusters: Precursors to N_2 Reduction, *Angew. Chem. Int. Ed.* **2001**, 40, 766-769.
3. Dube T.; **Ganesan, M.**; Conoci S.; Gambarotta S.; Yap G.P.A. Tetrametallic Divalent Samarium Cluster Hydride and Dinitrogen Complexes, *Organometallics*, **2000**, 18, 3716-3721.
2. **Ganesan, M.**; Krishnamurthy, S. S.; Nethaji, M.; Raghuraman, K. *Phosphorus, Sulfur and Silicon*, **1999**, 147, 355-355.
1. **Ganesan, M.**; Krishnamurthy, S.S.; Nethaji, M. Reductive carbonylation route to Co(0) and Co(I) carbonyl complexes containing bridging, chelating and cleaved diphosphazanes. Structures of $[\text{Co}(\text{CO})\{\text{P}(\text{OR})_2(\text{NHMe})\}_2\{\text{P}(\text{O})(\text{OR})_2\}\{\text{P}(\text{H})(\text{OR})_2\}]$ ($\text{R} = \text{CH}_2\text{CF}_3$, $\text{R} = \text{CH}_2\text{CH}_3$), $[\text{Co}_2(\text{CO})_2\{\text{m-MeN}\{\text{P}(\text{OR})_2\}_2\}_3]$ ($\text{R} = \text{CH}_2\text{CF}_3$), and $[\text{Co}(\text{CO})\{\text{h}2\text{-MeN}\{\text{P}(\text{OR})_2\}_2\}_2][\text{CoCl}_3(\text{OC}_4\text{H}_9)]$ ($\text{R} = \text{Ph}$) *J. Organomet. Chem.* **1998**, 570, 247-254.

Patent

Gabbai, F.P.; Mani, G; Pope, D.S.; Brown, J.D.; Wharry, D.L.; Hulburt, P.K. Catalyst composition, method of making same and its use in olefin oligomerization or polymerization. US 6833464 B2, 2004.

Invited Lecture:

1. Department of Chemistry, NUS, Singapore, 2008.
2. "Pyrrole Based Synthetic Receptors for Anions" - invited speaker - National Symposium on Frontiers in Main-Group and Organometallic Chemistry, IISc., Bangalore, Nov. 20th, 2010.
3. "Steric Effects on Atropisomerism Exhibited by Palladium Pincer Complexes and their Catalytic Applications" – invited speaker- Recent Advances In Inorganic Chemistry, Mar. 22-24th, 2012, School of Chemistry, Bharathidasan University, Trichy.

4. Late Transition Metal Complexes Bearing Novel Pyrrole-based Pincer and Multidentate Ligands, and Their Properties, **invited speaker- 15th Asian Chemical Congress**, Aug. 19-23, 2013.
5. Pyrrole-based flexidentate phosphine, polypyrazolyl, and Schiff base ligands for transition and alkali metal complexes, F. Albert Cotton Award in Synthetic Inorganic Chemistry: Symposium in honor of Professor Francois P. Gabbaï, - **invited speaker- 251st ACS National Meeting & Exposition**, San Diego, CA, United States, March 13-17, 2016 (2016), INOR-734.
6. Multidentate Ligands Supported Pd(II) and Mo(0) Complexes for Catalysis of Hydroamination, Suzuki and Norbornene Polymerization Reactions, **Indo-US Bilateral Workshop on Organometallic Chemistry, From Fundamentals to Applications**, Lonavala, India, Dec. 7-9, 2017.
7. Structural and Catalytic Properties of Metal Complexes Supported by Pyrrole-Based Pincer Type and Multidentate Ligands, **1st International Symposium on Main-group Molecules to Materials (MMM)**, Bangalore, 28th-31st October, 2018.
8. The Pyrrole-Based Unsymmetrical Pincer Ni(II) and Pd(II) Complexes: Highly Active Catalysts for Norbornene Polymerization. **MTIC Dec. 13th, 2019**, IIT-Guwahati.

Departmental Service

Served as a (1) faculty advisor for M.Sc. students (2) in-charge for obsolete item removal (3) research scholar coordinator (4) in-charge for Time Table and (5) in-charge for Single Crystal XRD and GCMS instruments.

Institute Service

- (1) JEE Advance paper setter (three times); (2) JAM paper Head Examiner (one time)
- (3) JAM and JEE exam paper corrections (two times); (4) Hall invigilation duty
- (5) NSO (served for 3 years)
- (6) Assistant Warden for LBS hall at IIT-Kharagpur (two years)
- (7) IIT-Pal lectures (available on you tube); (8) Warden, RP Hall Since Jan. 2023.

Completed Sponsored Research Projects

1. ISRD, Sponsoring Agent: IIT-Kharagpur, 2007, 5 lakhs.
Principal Investigator: Dr. G. Mani
2. Synthesis and structural characterization of organolanthanide complexes and their applications (Sponsoring Agent: DST, New Delhi, India Rs. 39.00 Lakhs).
Principal Investigator: Dr. G. Mani.
3. Olefin Polymerization by Organolanthanide Catalysts (Sponsoring Agent: CSIR, New Delhi, India Rs. 15.00 Lakhs). Principal Investigator: Dr. G. Mani.

4. Trivalent and Divalent Lanthanide Complexes Bearing Macrocyclic Ligands for Activation of CO₂ and Catalyses. (Sponsoring Agent: DST, New Delhi, Rs. 39 lakhs, from May 2013). Principal Investigator: Dr. G. Mani. (received '**excellent**' comment)
5. Group 10 Metal Complexes Bearing New NNN-Pincer Ligands for C-C Coupling Reactions. (CSIR from May 2013, Rs. 19 lakhs). Principal Investigator: Dr. G. Mani.
6. Design and Synthesis of Novel Pincer Ligands and Their Metal Complexes; Sponsoring Agent: Reliance Industries Ltd., India. Rs. 30.7 lakhs. Principal Investigator: Dr. G. Mani.
7. Transition Metal Complexes of Bidentate Pyrrole-based P- and N-Donor Ligands with Wide Bite Angles for Catalysis Reactions. Sponsoring Agent: DST, New Delhi, ~Rs. 41 lakhs, from Dec. 2016). Principal Investigator: Dr. G. Mani.
8. New Pyrrole Ring Bridged Phosphorus Containing Macrocycles with H-Bonding Functionality for Catalytic Conversion of CO₂, and New Unsymmetrical NHC Phosphine, and Sulfonyl Pincer Metal Complexes for Polymerization of Polar Norbornenes. Sponsoring Agent: DST, New Delhi, Rs. 32,71,400, from Dec. 2021. Principal Investigator: Dr. G. Mani.