

Dr. Ganesan Mani

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Research Area: Organometallics 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, India.
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: 9

No. of Ph.D students currently working: 5

No. of M. Sc. student projects completed: 24

Teaching Experience

First year Inorganic Chemistry theory and lab courses

Undergraduate Inorganic Chemistry theory and lab courses

Postgraduate Organometallics

Postgraduate Catalysis

Postgraduate Main Group Chemistry

Postgraduate lab courses.

Honors

1. American Chemical Society membership for three years.
2. Certificate of Recognition (2) from ACS for our publications and reviewing.

Publication List

Patent

G. Mani, and S. Kumar, D. Ghorai, T. Guchhait, Pyrrole-based Diphosphines and their Oxidized Products. Intellectual Property India. Patent No. 317093. **Granted in 2019**

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. Subramaniyan, 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.; Subramaniyan, 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. Subramaniyan, 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...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.

Before joining at IIT-KGP

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, $\text{MeN}\{\text{P}(\text{OR})_2\}_2$ (R = CH_2CF_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 $\text{Re}_2\text{Cl}_4(\mu\text{-dppm})_2$ (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 $[\text{Co}(\text{CO})\{\text{P}(\text{OR})_2(\text{NHMe})\}_2\{\text{P}(\text{O})(\text{OR})_2\}\{\text{P}(\text{H})(\text{OR})_2\}]$ (R = CH_2CF_3 , R = CH_2CH_3), $[\text{Co}_2(\text{CO})_2\{\text{m-MeN}\{\text{P}(\text{OR})_2\}_2\}_3]$ (R = CH_2CF_3), and $[\text{Co}(\text{CO})\{\text{h}2\text{-MeN}\{\text{P}(\text{OR})_2\}_2\}_2][\text{CoCl}_3(\text{OC}_4\text{H}_8)]$ (R = 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

Title: Synthesis and characterization of neutral Cr(III) catalysts for olefin oligomerization,

Delivered places:

1. Industry-University Cooperative Chemistry Program (IUCCP), Oct.13-15, 2003, Chemistry Department, Texas A&M University, College Station, TX.
2. 59th Southwest Regional Meeting Oct. 25-28, 2003, Oklahoma City, OK
3. 227th ACS meetings, Anaheim, CA., Mar 28-Apr 1, 2004.

Title: Dipyrrolide and 2,5-Dimethylpyrrolide Sm(II), Yb(II) Complexes: Dinitrogen Activation and Synthesis and characterization of neutral Cr(III) catalysts for ethylene oligomerization: "Aufbaureaktion",

Delivered places:

4. Indian Institute of Technology, Chennai, India, March, 2005.
5. Indian Institute of Science, Bangalore, India, March 22, 2005.
6. University of Pondicherry, India, April, 2005.
7. Department of Chemistry, NUS, Singapore, 2008.
8. "Pyrrole Based Synthetic Receptors for Anions" - invited speaker - National Symposium on Frontiers in Main-Group and Organometallic Chemistry, IISc., Bangalore, Nov. 20th, 2010.
9. "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.

10. 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.
11. 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.
12. 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.*
13. 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.
14. 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) JAM/JEE paper setter (two 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 youtube)

Completed Sponsored Research Projects (total ~1.83 crore)

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.