

## Curriculum vitae Prof. Fabio Ragaini

Fabio Ragaini was born in Milan, Italy, on 30/7/1962

13/3/87 “laurea” (equivalent to a Master degree) in Chemistry “cum laude” at the University of Milan

1/9/1987 -31/8/1988 fellowship from Istituto G. Donegani;

November 1988-October 1991 PhD in Chemistry at the University of Milan (advisor Prof. S. Cenini).

3/4/1992-31/10/1998 “Researcher” (Assistant Professor) at the University of Milan.

22/3-22/12/1993 visiting scientist at The Pennsylvania State University, with Prof. G. L. Geoffroy.

1/11/98-28/2/2008 Associate Professor in Inorganic Chemistry at the University of Milan.

Since 1/3/2008 Full Professor in Inorganic Chemistry at the University of Milan.

Since 1995-96 teaches the course of Metallorganic Chemistry (Homogeneous Catalysis).

From 1998-99 to 2008-09 has taught Stoichiometry.

Since 2009-10 teaches General and Inorganic Chemistry

He was one of the two chairmen of the “XI Congresso Del Gruppo Interdivisionale di Chimica Organometallica (CoGICO2014)”, Milano 2014.

He was part of the organizing committee of the 2<sup>nd</sup> Euchem conference on Nitrogen Ligands in Organometallic Chemistry and Homogeneous Catalysis", Como, 1996, the "VIII Italian Seminar on Catalysis", Verbania-Pallanza, 2005, and the "XXXV Congresso Nazionale della Divisione di Chimica Inorganica della Società Chimica Italiana", Milano 2007.

He was part of the scientific committee of the 8<sup>th</sup>, 9<sup>th</sup>, 10<sup>th</sup> and 11<sup>th</sup> International School of Organometallic Chemistry (ISOC 2011, ISOC 2013, ISOC2015, ISOC2017), of the X, XI, XII, and XIII Congresso del Gruppo Interdivisionale di Chimica Organometallica, (COGICO2012, Padova, COGICO2014, Milano, COGICO2106, Genova, COGICO2018, Firenze) and of the 9<sup>th</sup> International Symposium on Nano & Supramolecular Chemistry (Napoli, 2017), and member of the National Steering Committee per la 28<sup>th</sup> International Conference on Organometallic Chemistry (ICOMC-2018, Firenze).

Coordinator of a research unit on “Catalytic Membranes” in the Italian project FIRB 2003. He was the scientific head of two research contracts with Enichem, respectively on “New promoters for the palladium-phenanthroline catalytic system for the synthesis of carbamates and ureas from nitroarenes” and “Selective cracking of olefins for the production of propylene” and of one with

Techint on “Selective absorption of CO<sub>2</sub> and H<sub>2</sub>S in solvents”. Both contracts with Enichem led to the filing of a patent.

From 2006 to 2015 he was the delegate of Milano University within the Interuniversity Consortium for Chemical Reactivity and Catalysis (CIRCC). From 2010 to 2018 he was a member of the board of the "Gruppo Interdivisionale di Chimica Organometallica della Società Chimica Italiana" and from 2016 to 2018 he was its Coordinator.

Author of 120 papers on scientific journals, only five of which on national journals, a monograph entitled “Catalytic Reductive Carbonylation of Organic Nitro Compounds” (Kluwer Academic Publishers), 2 book chapters, 147 communications to congresses (several of which on invitation), and 3 patents.

He has collected over 3500 citations (not including those of the monograph, whose number is not available). h-index = 36.

Scientific interests are in the field of organometallic chemistry and homogeneous catalysis. The research activity has mainly, but not only, focused on the following topics:

1) Carbonylation reactions of nitroarenes to afford base chemicals (carbamates, ureas, isocyanates). The catalytic system described by Prof. Ragaini is the most active ever reported for this reaction.

2) Carbonylation reactions of nitroarenes to afford fine chemicals (allylic amines, indoles, pyrroles, oxazines). Together with Prof. Cenini, Prof. Ragaini was the first, back in 1996, to develop intermolecular versions of this coupling strategy, for which only intra-molecular reactions had been previously described. The 2006 JOC paper on the synthesis of indoles by this technique is among the most downloaded articles in that year for that journal. In 2017 Prof. Ragaini reported for the first time the use of formate esters as substitutes for gaseous CO in these reactions, thus simplifying the experimental procedure significantly.

3) Synthesis and use of nitrogen ligands (Schiff bases, phenanthrolines). The synthesis of bis-aryliminoacenaphthene (Ar-BIAN) ligands developed by Prof. Ragaini is now the most often employed one for this widely employed class of ligands.

4) Amination and aziridination reaction of olefins or activated C-H bonds (benzylic, allylic etc.) by organic azides. Together with Prof. Cenini and Prof. Gallo, Prof. Ragaini was a pioneer of the use of arylazides as aminating agents, a field now rapidly expanding.

5) Recently, a collaboration was started with Prof. Beller (Lickat, Rostock, Germany) on the use of a novel class of heterogeneous catalysts obtained by thermal decomposition of suitable metal complexes with nitrogen ligands in the presence of different supporting materials.

6) A special attention is given to mechanistic studies in all mentioned fields, as a mean to rationally improve the catalyst performance.

### Monograph

S. Cenini, F. Ragaini

*Catalytic Reductive Carbonylation of Organic Nitro Compounds*

Kluwer Academic Publishers, Dordrecht, The Netherland, **1997**.

### Articles

1) Effects of neutral ligands in the reductive carbonylation of nitrobenzene catalyzed by  $\text{Ru}_3(\text{CO})_{12}$  and  $\text{Rh}_6(\text{CO})_{16}$ .

S. Cenini, M. Pizzotti, C. Crotti, F. Ragaini, F. Porta. *J. Mol. Catal.* **1988**, *49*, 59-69.

2) Reactions of organic halides with the carbonyl anions  $[\text{M}(\text{CO})_4]^-$  (M = Rh, Ir). The crystal and molecular structure of  $[\text{PPN}][\text{IrBr}_2(\text{CO})_2(\text{CH}_2\text{CO}_2\text{Me})_2]$  and of  $[\text{PPN}][\text{Ir}(\text{CO})_2(\text{CH}_2\text{CN})_2]$  ( $\text{PPN}^+ = \text{Ph}_3\text{P}=\text{N}=\text{PPh}_3^+$ ).

F. Porta, F. Ragaini, S. Cenini, M. Pizzotti, F. Demartin. *Organometallics* **1990**, *9*, 929-935.

3) Reactivity of hydroxo, hydroperoxo and peroxo platinum(II) derivatives towards carbon oxides.

F. Porta, F. Ragaini, S. Cenini, O. Sciacovelli, M. Camporeale. *Inorg. Chim. Acta* **1990**, *173*, 229-235.

4) Synthesis and crystal structure of  $[\text{PPh}_4]_2 [\text{Ir}_4(\text{CO})_{10}(\text{CH}_2\text{COOMe})_2]$  and  $[\text{PPh}_4] [\text{Ir}_4(\text{CO})_{11}(\text{CH}_2\text{COOMe})]$ . First examples of iridium clusters bearing an alkyl-like ligand.

F. Ragaini, F. Porta, F. Demartin. *Organometallics* **1991**, *10*, 185-189.

5) Carbonylation of nitrobenzene to phenyl isocyanate and methyl carbamate catalyzed by palladium and rhodium activated by chelating nitrogen donor ligands.

S. Cenini, F. Ragaini, M. Pizzotti, F. Porta, G. Mestroni, E. Alessio. *J. Mol. Catal.* **1991**, *64*, 179-190.

6) Oxidation of primary and secondary aliphatic amines by  $\text{Mo}(\text{O})(\text{O}_2)_2\text{L}'\text{L}''$  ( $\text{L}' =$  hexamethylphosphoramide).

F. Porta, S. Tollari, F. Ragaini, C. Crotti. In *Dioxygen Activation and Homogeneous Catalytic Oxidation, Proceedings of the 4th International Symposium on Dioxygen Activation and Homogeneous Catalytic Oxidation*. L.I. Simándi (Ed.) Elsevier Sequoia, Amsterdam, **1991**, p. 531-536.

7) Synthesis of two novel pentanuclear Rhodium clusters bearing the alkyl-like ligands

$\text{CH}_2\text{COOMe}$  and  $-\text{CH}_2\text{CN}$ . X-ray structure of  $[\text{PPh}_4]_2[\text{Rh}_5(\mu\text{-CO})_6(\text{CO})_8(\text{CH}_2\text{CN})]$ .

F. Ragaini, F. Porta, A. Fumagalli, F. Demartin. *Organometallics* **1991**, *10*, 3785-3789.

8)  $[\text{Rh}(\text{CO})_4]^-$ ,  $[\text{Rh}_5(\text{CO})_{15}]^-$  and bimetallic clusters as catalysts for the carbonylation of nitrobenzene to methyl phenylcarbamate.

F. Ragaini, S. Cenini, A. Fumagalli, C. Crotti. *J. Organomet. Chem.* **1992**, 428, 401-408.

9) Ruthenium carbonyl catalyzed deoxygenation by carbon monoxide of *o*-substituted nitrobenzenes. Synthesis of benzimidazoles.

C. Crotti, S. Tollari, F. Ragaini, S. Cenini, F. Porta. *J. Mol. Catal.* **1992**, 72, 283-298.

10) Colloidal palladium: an improved method of preparation.

F. Porta, F. Ragaini, S. Cenini, G. Scari. *Gazz. Chim. Ital.* **1992**, 122, 361-3.

11) Mechanistic studies of the carbonylation of nitrobenzene catalyzed by the  $[\text{Rh}(\text{CO})_4]^-/\text{Bipy}$  system. X-ray structure of  $[\text{PPN}][\text{Rh}(\text{CO})_2\text{ON}(\text{C}_6\text{H}_3\text{Cl}_2)\text{C}(\text{O})\text{O}]$ .

F. Ragaini, S. Cenini, F. Demartin. *J. Chem. Soc., Chem. Commun.* **1992**, 1467-8.

12) Solving simple organometallic structures solely from X-ray powder diffraction data: the case of polymeric  $[\text{Ru}(\text{CO})_4]_n$ .

N. Masciocchi, M. Moret, P. Cairati, F. Ragaini, A. Sironi. *J. Chem. Soc., Dalton Trans.* **1993**, 471-5.

13) Ab initio XRPD structure determination of metal carbonyl clusters: the case of  $[\text{HgRu}(\text{CO})_4]_4$ .

N. Masciocchi, P. Cairati, F. Ragaini, A. Sironi. *Organometallics* **1993**, 12, 4499-4502.

14) Reduction of nitrobenzene to aniline by  $\text{CO}/\text{H}_2\text{O}$ , catalyzed by  $\text{Ru}_2(\text{CO})_{12}$ . Strong activating ability of rigid  $\alpha$ -diimine ligands.

F. Ragaini, S. Cenini, S. Tollari. *J. Mol. Catal.* **1993**, 85, L1-L5

15) Synthesis of some benzotriazoles by deoxygenation of *o*-nitrophenylazocompounds by tertiary amines and CO.

M. Pizzotti, F. Ragaini, S. Cenini. *Gazz. Chim. Ital.* **1993**, 123, 683-686.

16) Halide-induced disproportionation of  $\text{Fe}_3(\text{CO})_{12}$  to form a radical anion  $[\text{Fe}_3(\text{CO})_{11}]^{\bullet-}$  and its characterization by single-crystal X-ray diffraction.

F. Ragaini, D. L. Ramage, J-S. Song, G. L. Geoffroy, A. L. Rheingold. *J. Am. Chem. Soc.* **1993**, 115, 12183-12184.

17) Mechanistic studies of the carbonylation of nitrobenzene catalyzed by the  $[\text{Rh}(\text{CO})_4]^-/\text{nitrogen base}$  system. X-ray structure of  $[\text{PPN}][\text{Rh}(\text{CO})_2\text{ON}(\text{C}_6\text{H}_3\text{Cl}_2)\text{C}(\text{O})\text{O}]$ .

F. Ragaini, S. Cenini, F. Demartin. *Organometallics* **1994**, 13, 1178-1189.

18) Intramolecular amination of olefins. Synthesis of 2-substituted-4-quinolones from 2-nitrochalcones catalyzed by ruthenium.

S. Tollari, S. Cenini, F. Ragaini, L. Cassar. *J. Chem. Soc., Chem. Commun.* **1994**, 1741-1742.

19) Radical processes in the reduction of nitrobenzene promoted by iron carbonyl clusters. X-ray crystal structures of  $[\text{Fe}_3(\text{CO})(\mu_3\text{-NPh})]^{2-}$ ,  $[\text{HFe}_3(\text{CO})_9(\mu_3\text{-NPh})]^-$ , and the radical anion  $[\text{Fe}_3(\text{CO})_{11}]^{\bullet-}$ .

F. Ragaini, J.-S. Song, D. L. Ramage, G.L. Geoffroy, A. L. Rheingold. *Organometallics* **1995**, *14*, 387-400.

20) New chelating nitrogen ligands. X-ray crystal structure of  $\text{Rh}(\text{CO})_2(\text{BBOM})$  (BBOMH= bis-(2-benzoxazolil)methane).

F. Ragaini, M. Pizzotti, S. Cenini, A. Abbotto, G. A. Pagani, F. Demartin. *J. Organomet. Chem.* **1995**, *489*, 107-112.

21) Homogeneous catalysis in water without charged ligands. Reduction of nitrobenzene to aniline by  $\text{CO}/\text{H}_2\text{O}$  catalysed by  $[\text{Rh}(\text{CO})_4]^-$ .

F. Ragaini, S. Cenini. *J. Mol. Catal. A.* **1996**, *105*, 145-148.

22) Mechanistic studies of palladium-catalysed carbonylation reactions of nitro compounds to isocyanates, carbamates and ureas.

F. Ragaini, S. Cenini. *J. Mol. Catal. A* **1996**, *109*, 1-25.

23) Mechanistic study of the phase-transfer-catalyzed reduction of nitrobenzene to aniline by iron carbonyl complexes. Role of the radical anion  $[\text{Fe}_3(\text{CO})_{11}]^{\bullet-}$ .

F. Ragaini. *Organometallics* **1996**, *15*, 3572-3578.

24) Allylic Amination of Cyclohexene Catalysed by Ruthenium Complexes. A New Reaction Involving an *inter-Molecular* Catalytic C-H Functionalization.

S. Cenini, F. Ragaini, S. Tollari, D. Paone. *J. Am. Chem. Soc.* **1996**, *118*, 11964-11965.

25) Catalytic carbonylation reactions of organic nitro compounds. A route alternative to the use of phosgene.

F. Ragaini, S. Cenini. *Chim. Ind.(Milano)* **1996**, *78*, 421-427.

26) Activation of the N-H bond of ethyl urethane and urea by ruthenium hydride complexes. Unexpected loss of alcohol or ammonia to yield isocyanato complexes and the X-ray crystal structure of *cis,trans*- $\text{HRu}(\text{NCO})(\text{CO})_2(\text{PPh}_3)_2$ .

F. Ragaini, T. Longo, S. Cenini, F. Demartin. *J. Chem. Soc., Dalton Trans.* **1996**, 3221-3226.

27) Transition metal-mediated N-heterocyclisation reactions. Synthesis of 2-phenylindole by reduction by CO of 2-nitrostilbene catalysed by  $[\text{Rh}(\text{CO})_4]^-$ .

F. Ragaini, S. Tollari, S. Cenini, E. Bettetini. *J. Mol. Catal. A* **1996**, *111*, 91-96.

28) Addition of ethyl urethane to olefins; a new approach to the synthesis of aliphatic carbamates.

F. Ragaini, T. Longo, S. Cenini. *J. Mol. Catal. A* **1996**, *110*, L171-L175.

29) Processi chimici puliti per il futuro. Studi meccanicistici sulla sintesi di uree e di carbammati da nitroderivati aromatici e ossido di carbonio catalizzata da complessi carbonilici del rutenio.

F. Ragaini, A. Ghitti, S. Cenini. *Rendiconti dell'Istituto Lombardo di Scienze e Lettere, B*, **1996**, *130*, 207-217.

30) Carbonylation of nitrobenzene catalysed by palladium and heteropolyanions; a mechanistic approach.

F. Ragaini, M. Macchi, S. Cenini. *J. Mol. Catal. A* **1997**, *127*, 33-42.

31) Use of Imino Grignard Reagents in Inorganic Chemistry. Synthesis and X-Ray Crystal Structure of  $[\text{Pd}(\text{Cl})(\text{Py})(\mu\text{-}2,6\text{-Pr}^i\text{C}_6\text{H}_3\text{NH})]_2$ .

F. Ragaini, S. Cenini, F. Demartin. *J. Chem. Soc., Dalton Trans.* **1997**, 2855-6

32) Ab Initio XRPD Structure Determination of Organometallic Compounds: the case of  $\text{Pd}(\text{Phen})(\text{C}(\text{O})\text{N}(\text{Me})\text{OC}(\text{O}))$ , a Model Intermediate in the Palladium-Phenanthroline-Catalyzed Reductive Carbonylation of Aromatic Nitro Compounds.

N. Masciocchi, F. Ragaini, S. Cenini, A. Sironi. *Organometallics* **1998**, *17*, 1052-1057.

33) Intermediate Formation of Anilines in the Synthesis of Schiff Bases from Nitroarenes and Aldehydes.

F. Ragaini, S. Cenini. *J. Mol. Catal. A* **1999**, *144*, 405-410.

34) Investigation of the Possible Role of Arylamine Formation in the *ortho*-Substituted Nitroarene Reductive Cyclisation Reactions to Afford Heterocycles.

F. Ragaini, P. Sportiello, S. Cenini. *J. Organomet. Chem.* **1999**, *577*, 283-291.

35) The Role of the Co-catalyst in the Reductive Carbonylation of Aromatic Nitro Derivatives Catalyzed by Transition Metal Carbonyl Clusters.

S. Cenini, F. Ragaini. In *Metal Clusters in Chemistry*, Vol. 2, capitolo 4, p. 697-714, Wiley-VCH, Weinheim (Germania), **1999**.

36) Allylic Amination of Unactivated Olefins by Nitroarenes, Catalysed by Ruthenium Complexes. A Reaction Involving an Intermolecular C-H Functionalization.

F. Ragaini, S. Cenini, S. Tollari, G. Tummolillo, R. Beltrami. *Organometallics* **1999**, *18*, 928-942.

37) Mechanistic Study of the Ru<sub>3</sub>(CO)<sub>12</sub>/Tetraalkylammonium Chloride Catalyzed Carbonylation Reactions of Nitroarenes to Carbamates and Ureas; a Completely Revised Picture.

F. Ragaini, A. Ghitti, S. Cenini. *Organometallics* **1999**, *18*, 4925-4933.

38) Investigation of the Reactivity of Palladium(0) Complexes with Nitroso Compounds: Relevance to the Palladium-Phenanthroline Catalysed Carbonylation Reactions of Nitroarenes.

E. Gallo, F. Ragaini, S. Cenini, F. Demartin. *J. Organomet. Chem.* **1999**, *586*, 190-195

39) Promotion of the [PPN][Rh(CO)<sub>4</sub>] Catalysed Carbonylation of Nitrobenzene by 2-Hydroxypyridine and Related Molecules: an Apparent Bifunctional Activation.

F. Ragaini, E. Gallo, S. Cenini. *J. Organomet. Chem.* **2000**, *593-594*, 109-118.

40) Mechanistic Study of the Ru<sub>3</sub>(CO)<sub>12</sub>/Chloride Catalyzed Carbonylation Reactions of Nitroarenes to Carbamates and Ureas; the Role of the Alkylammonium Cation.

F. Ragaini, S. Cenini. *J. Mol. Catal. A* **2000**, *161*, 31-38.

41) Deactivation of a [PPN][Rh(CO)<sub>4</sub>]-Based Catalytic System (PPN<sup>+</sup> = (PPh<sub>3</sub>)<sub>2</sub>N<sup>+</sup>). The First Decomposition Reaction of PPN<sup>+</sup> and the Formation of [Rh<sub>10</sub>P(CO)<sub>22</sub>]<sup>3-</sup>.

F. Ragaini, A. Sironi, A. Fumagalli. *Chem. Commun.* **2000**, 2117-2118.

42) Amination of Benzylic C-H Bonds by Aryl Azides Catalysed by Co<sup>II</sup>(porphyrin) complexes. A New Reaction Leading to Secondary Amines and Imines.

S. Cenini, E. Gallo, A. Penoni, F. Ragaini, S. Tollari. *Chem. Commun.* **2000**, 2265-2266.

43) Reduction of Nitrobenzene to Aniline by CO/H<sub>2</sub>O, Catalysed by Ru<sub>3</sub>(CO)<sub>12</sub>/Chelating Diimines

F. Ragaini, S. Cenini, M. Gasperini. *J. Mol. Catal. A* **2001**, *174*, 51-57.

44) Synthesis of N-Arylpyrroles, Hetero Diels-Alder Adducts, and Allylic Amines by Reaction of Unfunctionalized Dienes with Nitroarenes and Carbon Monoxide, Catalyzed by Ru(CO)<sub>3</sub>(Ar-BIAN).

F. Ragaini, S. Cenini, E. Borsani, M. Dompé, E. Gallo, M. Moret. *Organometallics* **2001**, *20*, 3390-3398.

45) Synthesis of Ar-BIAN Ligands (Ar-BIAN = bis(aryl)acenaphthenequinonediimine) Having Strong Electronwithdrawing Substituents on the Aryl Rings and their Relative Coordination Strength towards Pd(0) and Pd(II) Complexes.

M. Gasperini, F. Ragaini, S. Cenini, *Organometallics* **2002**, *21*, 2950-2957.

46) The Crystal Structure of the Organometallic Polymer [Pd{CH<sub>2</sub>C(O)Me}Cl]<sub>n</sub>, determined by X-ray Powder Diffraction Methods.

N. Masciocchi, F. Ragaini, A. Sironi. *Organometallics* **2002**, *21*, 3489-92.

47) Le Metalloporfirine: un Efficace Modello di Enzimi Naturali. Studio Meccanicistico della Reazione Catalitica di Amminazione di Gruppi Benzilici.

E. Gallo, F. Ragaini, A. Penoni, E. Mangioni, S. Cenini. *Rendiconti dell'Istituto Lombardo di Scienze e Lettere, B* **2001**, *135*, 241-54 (printed in 2003).

48) Synthesis of Oxazines and N-Arylpyrroles by Reaction of Unfunctionalized Dienes with Nitroarenes and Carbon Monoxide, Catalyzed by Palladium-Phenanthroline Complexes.

F. Ragaini, S. Cenini, D. Brignoli, M. Gasperini, E. Gallo. *J. Org. Chem.* **2003**, *68*, 460-6.

49) Amination of Benzylic C-H Bonds by Arylazides Catalyzed by Co<sup>II</sup>(porphyrin) Complexes. A Synthetic and Mechanistic Study.

F. Ragaini, A. Penoni, E. Gallo, S. Tollari, C. Li Gotti, M. Lapadula, E. Mangioni, S. Cenini. *Chem. Eur. J.* **2003**, *9*, 249-259.

50) Cyclopropanation of Olefins with Diazoalkanes Catalyzed by Co(II)(porphyrin) Complexes. A Synthetic and Mechanistic Investigation and the Molecular Structure of Co(III)(TPP)(CH<sub>2</sub>CO<sub>2</sub>Et) (TPP=Dianion of *meso*-Tetraphenylporphyrin)

A. Penoni, R. Wanke, S. Tollari, E. Gallo, D. Musella, F. Ragaini, F. Demartin, S. Cenini. *Eur. J. Inorg. Chem.* **2003**, 1452-60.

51) Carbonylation of Nitrobenzene to N-Methyl Phenylcarbamate Catalyzed by Palladium-Phenanthroline Complexes. Bifunctional Activation by Anthranilic Acid.

M. Gasperini, F. Ragaini, S. Cenini, E. Gallo. *J. Mol. Catal. A* **2003**, *204-205*, 107-114.

52) The Carbonylation Reaction of Nitrobenzene to Methyl Phenylcarbamate; New Highly Efficient Promoters for the Palladium-Phenanthroline Catalytic System Based on Phosphorus Acids.

F. Ragaini, C. Cognolato, M. Gasperini, S. Cenini. *Angew. Chem. Int. Ed.* **2003**, *42*, 2886-89; *Angew. Chem.* **2003**, *115*, 2992-95.

53) Method of Establishing the Lewis Acidity of a Metal Fragment Based on the Relative Binding Strength of Ar-BIAN Ligands (Ar-BIAN = Bis(aryl)acenaphthenequinonediimine).

M. Gasperini, F. Ragaini. *Organometallics* **2004**, *23*, 995-1001.

54) Phosphorus Acids as Highly Efficient Promoters for the Palladium-Phenanthroline Catalyzed Carbonylation of Nitrobenzene to Methyl Phenylcarbamate.

F. Ragaini, M. Gasperini, S. Cenini. *Adv. Synth. Catal.* **2004**, *346*, 63-71.



55) Allylic Amination of Unfunctionalized Olefins by Nitroarenes and CO, Catalyzed by Ru<sub>3</sub>(CO)<sub>12</sub>/Ph-BIAN (Ph-BIAN = bis(phenylimino)acenaphthenequinone): Extension to the Synthesis of Allylic Amines with Strongly Electronwithdrawing or Electrondonating Groups on the Aryl Ring.

F. Ragaini, S. Cenini, F. Turra, A. Caselli. *Tetrahedron* **2004**, *60*, 4989-4994.

56) Synthesis of mixed Ar,Ar'-BIAN Ligands (Ar-BIAN = bis(aryl)acenaphthenequinonediimine). Measurement of the Coordination Strength of Hemilabile Ligands with Respect to Their Symmetrical Counterparts.

M. Gasperini, F. Ragaini, E. Gazzola, A. Caselli, P. Macchi. *Dalton Trans.* **2004**, 3376-3382.

57) Copper Catalysed 1,4-Addition of Organozinc Reagents to  $\alpha,\beta$ -Unsaturated Carbonyl Compounds: A Mechanistic Investigation.

E. Gallo, F. Ragaini, L. Bilello, S. Cenini, C. Gennari, U. Piarulli. *J. Organomet. Chem.* **2004**, *689*, 2169-2176.

58) Synthesis of Triarylphosphines Having *para* -SH and -SMe Groups. Preparation of Their Complexes and Formation of a Monolayer on a Gold Surface.

F. Ragaini, L. Lunardi, D. Tomasoni, V. Guglielmi. *J. Organomet. Chem.* **2004**, *689*, 3621-3630.

59) Structural Determination of Ruthenium Porphyrin Complexes Relevant to Catalytic Epoxidation of Olefins.

E. Gallo, A. Caselli, F. Ragaini, S. Fantauzzi, N. Masciocchi, A. Sironi, S. Cenini. *Inorg. Chem.* **2005**, *44*, 2039-2049.

60) Carbonylation of Dinitrotoluene to Dimethyl Toluendicarbamate; High Efficiency of Phosphorus Acids as Promoters for the Palladium-Phenanthroline Catalytic System.

M. Gasperini, F. Ragaini, C. Cazzaniga, S. Cenini. *Adv. Synth. Catal.* **2005**, *347*, 105-120.

61) Using Ring Strain to Inhibit a Decomposition Path: First Synthesis of an Alkyl-BIAN ligand (Alkyl-BIAN = bis(alkyl)acenaphthenequinonediimine)

F. Ragaini, M. Gasperini, E. Gallo, P. Macchi. *Chem. Commun.* **2005**, 1031-1033.

62) Catalytic Amination Reactions Mediated by Co(II) Schiff Base Complexes.

A. Caselli, E. Gallo, F. Ragaini, A. Oppezzo, S. Cenini. *J. Organomet. Chem.* **2005**, *690*, 2142-2148.

63) The Palladium-Phenanthroline Catalyzed Carbonylation of Nitroarenes to Diarylureas. Effect of Chloride and Diphenylphosphinic Acid.

M. Gasperini, F. Ragaini, C. Remondini, A. Caselli, S. Cenini. *J. Organomet. Chem.* **2005**, *690*, 4515-4529.

64) Synthesis of Indoles by *Inter*-molecular Cyclization of Unfunctionalised Nitroarenes and Alkynes, Catalysed by Palladium-Phenanthroline Complexes

F. Ragaini, A. Rapetti, E. Visentin, M. Monzani, A. Caselli, S. Cenini. *J. Org. Chem.* **2006**, *71*, 3748-3753.

65) Origin of the Deactivation in the Styrenes Aziridination by Aryl Azides, Catalyzed by Ruthenium Porphyrin Complexes. Structural Characterization of a  $\Delta^2$ -1,2,3-Triazoline Ru<sup>II</sup>(TPP)CO Complex

S. Fantauzzi, E. Gallo, A. Caselli, F. Ragaini, P. Macchi, N. Casati, S. Cenini. *Organometallics* **2005**, *24*, 4710-4713

66) Fine chemicals by reductive carbonylation of nitroarenes, catalyzed by transition metal complexes.

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## Patents

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