Dr. Arash Ghaderi

Associate Professor in Organic Chemistry

(October 2019 - Present)

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I. Educational Records

-B.Sc. in *Chemistry, Shiraz University (**Sept 23, 2001 - Jul 1, 2005**), Shiraz, Iran.*

-M.Sc. in *Organic Chemistry, Bu-Ali Sina University (**Sept 23, 2005 - Sept 5, 2007**), Hamadan, Iran.*

-Ph.D. in *Organic Chemistry, Shiraz University (**Sept 23, 2007 – Jan 17, 2012**), Shiraz, Iran.*

Title of my M.Sc. thesis:

Part A: *Synthesis of Quinolines under Green Conditions*

&

Part B: *Synthesis of Unique Nano-Capsule Based on Benzenesulfonamide Cryptand*

(**Supervisor:** Professor Mohammad Ali Zolfigol)

Title of my Ph.D. thesis:

Part A: *Synthesis and Characterization of Palladium Nanoparticles Supported on Inorganic and Organic Beds and Their Applications in Carbon-Carbon Bond Formation*

&

Part B: *Nucleophilic Addition to the in situ Generated Azomethine Ylide Intermediates via Nontraditional Reactions*

(**Supervisors:** Professor Habib Firouzabadi & Professor Nasser Iranpoor)

II. Research Area

Organic Reactions Catalyzed by Organometallics and Nanomaterials and Photoreactions

III. Awards and Honors

M.Sc. Graduated with Honors, ***September 2007****.*

First-Rank Student in the PhD Entrance Exam of Shiraz University, ***September 2007****.*

Member of Shiraz University Office for Brilliant Talents, Shiraz University, ***September 2007****.*

Member of Elite' National Foundation of Iran, ***September 2008****.*

Iran Nanotechnology Initiative Council Award for my PhD Thesis, ***September 2009****.*

The Scholarship of the Ministry of Sciences, Research and Technology of Iran, ***September 2009****.*

Research Fellow at Osaka University, Japan, ***February 2012 – July 2012****. (Supervisor: Professor Nobuaki Kambe).*

IV. Work Experiences

Associate Professor at University of Hormozgan, Bandar Abbas, Iran.
Assistant Professor at University of Hormozgan, Bandar Abbas, Iran.
Assistant Professor at Osaka University, Osaka, Japan.
Teaching Assistant at Shiraz University, Shiraz, Iran.
Invited Lecturer at Hormozgan University of Medical Sciences

Lecturer in B.Sc. and MSc. courses:

- *General Chemistry*
- *General Chemistry Laboratories*
- *Organic Chemistry*

- *Organic Chemistry Laboratories*
- *Advanced Organic Chemistry*
- *Principles of Organometallic Chemistry*
- *Organic Synthesis*
- *Applications of the Spectroscopy in Organic Chemistry*
- *Advanced Spectroscopy*

Expert in working with the following instruments:

- *NMR Instruments*
- *GC*
- *GC-MS*
- *HPLC and GPC*
- *FT-IR*

V. List of Publications

1. Habib Firouzabadi, Nasser Iranpoor, Maasoumeh Jafarpour, **Arash Ghaderi**; "Silica-Gel Catalyzed Highly Selective C-S Bond Formation via Michael Addition of Thiols to α, β-Unsaturated Ketones under Solvent-Free Conditions" *J. Mol. Catal. A: Chem.* **2006,** *249*, 98-102.

2. Habib Firouzabadi, Nasser Iranpoor, Maasoumeh Jafarpour, **Arash Ghaderi**; "$ZrOCl_2 \cdot 8H_2O$ as a Highly Efficient and the Moisture Tolerant Lewis Acid Catalyst for Michael Addition of Amines and Indoles to α, β- Unsaturated Ketones under Solvent-Free Conditions" *J. Mol. Catal. A: Chem.* **2006,** *252*, 150-155.

3. Habib Firouzabadi, Nasser Iranpoor, Maasoumeh Jafarpour, **Arash Ghaderi**; "$ZrOCl_2 \cdot 8H_2O$/Silica Gel as a New Efficient and a Highly Water–Tolerant Catalyst System for Facile Condensation of Indoles with Carbonyl Compounds under Solvent-Free Conditions" *J. Mol. Catal. A: Chem.* **2006,** *253*, 249-251.

4. Mohammad Ali Zolfigol, Peyman Salehi, **Arash Ghaderi**, Morteza Shiri, Zahra Tanbakouchian; "An Eco-Friendly Procedure for the Synthesis of Polysubstituted Quinolines under Aqueous Media" *J. Mol. Catal. A: Chem.* **2006,** *259*, 253-258.

5. Mohammad Ali Zolfigol, Peyman Salehi, **Arash Ghaderi**, Morteza Shiri; "A Catalytic and Green Procedure for Friedlander Quinoline Synthesis in Aqueous Media" *Catal. Commun.* **2007,** *8*, 1214-1218.

6. Mohammad Ali Zolfigol, Peyman Salehi, **Arash Ghaderi**, Morteza Shiri; "Iodine-Catalyzed Friedlander Quinoline Synthesis under Solvent-Free Conditions" *J. Chin. Chem. Soc.* **2007,** *54*, 267-271.

7. Mohammad Ali Zolfigol, Peyman Salehi, , Morteza Shiri, Toktam Rastegar, **Arash Ghaderi**; "Silica Sulfuric Acid as an Efficient Catalyst for the Friedlander Quinoline Synthesis from Simple Ketones and Ortho-Amino Aryl Ketones under Microwave Irradiation" *J. Iran. Chem. Soc.* **2008,** *5*, 490-497.

8. Habib Firouzabadi, Nasser Iranpoor, Somayeh Kazemi, **Arash Ghaderi**, Atefeh Garzan; "Highly Efficient Halogenation of Organic Compounds with Halides Catalyzed by Cerium(III) Chloride Heptahydrate Using Hydrogen Peroxide as the Terminal Oxidant in Water" *Adv. Synth. Catal.* **2009,** *351*, 1925-1932.

9. Habib Firouzabadi, Nasser Iranpoor, **Arash Ghaderi**, Maryam Ghavami, S. Jafar Hoseini; "Palladium Nano-Particles Supported on Aminopropyl Functionalized Clay as Efficient Catalysts for Phosphine-Free C-C Bond Formation via Mizoroki-Heck and Suzuki-Miyaura Reactions" *Bull. Chem. Soc. Jpn.* **2011,** *84*, 100-109 [Highlighted in *SYNFACTS* **2011,** *4*, 450].

10. Habib Firouzabadi, Nasser Iranpoor, **Arash Ghaderi**; "Gelatin as a Bioorganic Reductant, Ligand and Support for Palladium Nanoparticles. Application as a Catalyst for Ligand- and Amine-Free Sonogashira-Hagihara Reaction" *Org. Biomol. Chem.* **2011,** *9*, 865-871.

11. Habib Firouzabadi, Nasser Iranpoor, **Arash Ghaderi**; "Solvent-Free Mizoroki-Heck Reaction Catalyzed by Palladium Nano-Particles Deposited on Gelatin as the Reductant, Ligand and the Non-Toxic and Degradable Natural Product Support" *J. Mol. Catal. A: Chem.* **2011**, *347*, 38-45.

12. Habib Firouzabadi, Nasser Iranpoor, **Arash Ghaderi**, Maryam Ghavami; "Cerium (IV) Oxide as a Neutral Catalyst for Aldehyde-Induced Decarboxylative Coupling of L-Proline with Triethyl Phosphite and Nitromethane" *Tetrahedron Lett.* **2012**, *53*, 5515-5518.

13. **Arash Ghaderi**, Takanori Iwasaki, Asuka Fukuoka, Jun Terao, Nobuaki Kambe; "Nickel-Catalyzed Coupling of Thiomethyl-Substituted 1,3-Benzothiazoles with Secondary Alkyl Grignard Reagents" *Chem. Eur. J.* **2013**, *19*, 2951-2955.

14. Ardeshir Khazaei, Sadegh Rahmati, **Arash Ghaderi,** Leila Roshani; "Palladium Nanoparticles Supported on Gum Arabic as a Reusable Catalyst for Solvent-Free Mizoroki-Heck Reaction" *J. Iran. Chem. Soc.* **2014**, *11*, 263-269.

15. Habib Firouzabadi, Nasser Iranpoor, **Arash Ghaderi**, Mohammad Gholinejad, Sajjad Rahimi, Safura Jokar; "Design and Synthesis of a New Phosphinite-Functionalized Clay Composite for the Stabilization of Palladium Nanoparticles. Application as a Recoverable Catalyst for C-C Bond Formation Reactions" *RSC Adv.* **2014**, *4*, 27674-27682.

16. Abed Rostami, Amin Rostami, **Arash Ghaderi**, Mohammad Ali Zolfigol; "Ligand-Free Cu-Catalyzed Odorless Synthesis of Unsymmetrical Sulfides through Cross-Coupling Reaction of Aryl/Benzyl/Alkyl Halides with an Aryl Boronic Acid/S8 System as a Thiolating Agent in PEG" *RSC Adv.* **2015**, *5*, 37060-37065.

17. Abed Rostami, Amin Rostami, **Arash Ghaderi**; "Copper-Catalyzed Thioetherification Reactions of Alkyl Halides, Triphenyltin Chloride and Arylboronic Acids with Nitroarenes in the Presence of Sulfur Sources" *J. Org. Chem.* **2015**, *80*, 8694-8704.

18. Mohammad Gholinejad, Mehran Razeghi, **Arash Ghaderi**, Pullithadathil Biji; "Palladium Supported on Phosphinite Functionalized Fe_3O_4 Nanoparticles as a New Magnetically Separable Catalyst for Suzuki-Miyaura Coupling Reaction in Aqueous Media" *Catal. Sci. Technol.* **2016**, *6*, 3117-3127.

19. **Arash Ghaderi**, Mohammad Gholinejad, Habib Firouzabadi; "Palladium Deposited on Naturally Occurring Supports as a Powerful Catalyst for Carbon-Carbon Bond Formation Reactions" *Curr. Org. Chem.* **2016**, *20*, 327-348.

20. **Arash Ghaderi**; "Advances in Transition-Metal Catalyzed Thioetherification Reactions of Aromatic Compounds" *Tetrahedron* **2016**, *72*, 4758-4782.

21. Abed Rostami, Amin Rostami, **Arash Ghaderi**, Mohammad Gholinejad, Sajedeh Gheisarzadeh; "Copper-Catalyzed C-S Bond Formation via the Cleavage of C-O Bonds in the Presence of S_8 as the Sulfur Source" *Synthesis* **2017**, *49*, 5025-5038.

22. Fatemeh Zamiran, **Arash Ghaderi**; "Nickel-Catalyzed Denitrative Etherification of Activated Nitrobenzenes" *J. Iran. Chem. Soc.* **2019**, *16*, 293-299.

23. **Arash Ghaderi,** Takanori Iwasaki, Nobuaki Kambe; "Pivalic Acid-Assisted Rh(III)-Catalyzed C-H Functionalization of 2-Arylpyridine Derivatives Using Arylsilanes" *Asian J. Org. Chem.* **2019**, *8*, 1344-1347.

24. Sajedeh Maddah Roodan, **Arash Ghaderi**; "Copper-Catalyzed Demethylative Esterification of Arylmethylketones: A New Route for the Synthesis of Benzocaine" *J. Iran. Chem. Soc.* **2019**, *16*, 2327-2332.

25. Roghaye Soltani, **Arash Ghaderi**; "Metal-Free Aerobic Oxidative Esterification of Aromatic Aldehydes Promoted by Potassium Fluoride (KF)" *J. Chin. Chem. Soc.* **2019**, *66*, 1572-1576.

V. List of Papers Presented in National Congresses and Seminars

1. Mohammad Ali Zolfigol, Peyman Salehi, **Arash Ghaderi**, Mohsen Shayegh; *"Synthesis of Quinoline Derivatives under Green Conditions"* 12th Iranian seminar of Organic Chemistry; March 7-9 **(2006)** p. 239, Ahwaz, Iran.
2. Mohammad Ali Zolfigol, Gholamabbas Chehardoli, Mohammad Mokhlesi, **Arash Ghaderi**; *"Synthesis of Xanthenes with Aldehydes and Dimedone in the Presence of a Catalytic Amount of Silica Chloride under Mild and Heterogeneous Conditions"* 13th Iranian seminar of Organic Chemistry; September 7-9 **(2006)** p. 83, Hamadan, Iran.

3. Mohammad Ali Zolfigol, Peyman Salehi, **Arash Ghaderi**, Morteza Shiri, Zahra Tanbakouchian; *"An Eco-Friendly Procedure for the Synthesis of Polysubstituted Quinolines under Aqueous Media"* 13th Iranian seminar of Organic Chemistry; September 7-9 **(2006)** p. 179, Hamadan, Iran.

4. Mohammad Ali Zolfigol, Peyman Salehi, **Arash Ghaderi**, Morteza Shiri; *"Friedlander Synthesis of Quinoline Derivatives Using Lewis Acids in Water"* 13th Iranian seminar of Organic Chemistry; September 7-9 **(2006)** p. 201, Hamadan, Iran.

5. Mohammad Ali Zolfigol, Ramin Ghorbani-Vaghei, Peyman Salehi, Shadpour Mallakpour, Fariba Nazari, **Arash Ghaderi**, Mostafa Baghbanzadeh; *"Synthesis of Some New Nano-Tube Like Macrocycles Based on Kryptofix"* 13th Iranian seminar of Organic Chemistry; September 7-9 **(2006)** p. 202, Hamadan, Iran.

6. Mohammad Ali Zolfigol, Peyman Salehi, , Morteza Shiri, Toktam Rastegar, **Arash Ghaderi**; *"Silica Sulfuric Acid as an Efficient Catalyst for the Friedlander Quinoline Synthesis from Simple Ketones and Ortho-Amino Aryl Ketones under Microwave Irradiation"* 14th Iranian seminar of Organic Chemistry; March 4-6 **(2008)** p. 356, Zabol, Iran.

VIII. List of Papers Presented in International Congresses and Seminars

1. Mohammad Ali Zolfigol, **Arash Ghaderi**, Peyman Salehi, Ramin Ghorbani-Vaghei, Shadpour Mallakpour; "Synthesis of Unique Nano-Capsule: As a First Example of Benzosulfonamide Cryptand" International Conference on Organic Chemistry; June 5-9 **(2007)** p. 184, Erzurum, Turkey.

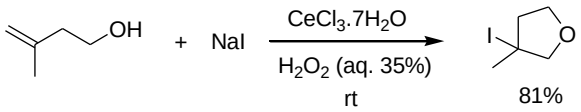
2. Habib Firouzabadi, Nasser Iranpoor, **Arash Ghaderi**, S. Jafar Hoseini; "Mizoroki-Heck Reaction Catalyzed by Palladium Nanoparticles Supported on Organofunctionalized Clay in NMP Solvent" Eleventh Tetrahedron Symposium; June 22-24 **(2010)** Beijing, China.

3. **Arash Ghaderi**, Takanori Iwasaki, Asuka Fukuoka, Jun Terao, Nobuaki Kambe; "Nickel-Catalyzed C-C Bond Formation Reaction Using Secondary Alkyl Grignard Reagent" 11th International Congress of Young Chemists (Youngchem2013); October 9-13 **(2013)** Poznan, Poland (Oral Presentation).

Research Statement

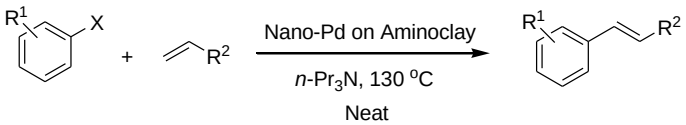
My research is focused on the design of new inorganic and organometallic catalysts and their applications in coupling reactions. My attention has been mainly paid to the transition metal-based catalysts such as cerium, zirconium, rhodium, palladium, copper and nickel. Utilizing these catalysts and also metal nanoparticles, my aim has been the construction of C-C, C-N, C-P, C-S, C-F and C-B bonds. In addition, synthesis and characterization of metal nanoparticles and their applications in C-C bond formation reactions are the subjects that have been the center of my attention during the past years.

Along this line, a new environmentally friendly catalytic method is described for the efficient monoiodination and bromination of arenes and also iodoetherification and iodolactonization of olefins using hydrogen peroxide as the terminal oxidant in aqueous media (Scheme 1).



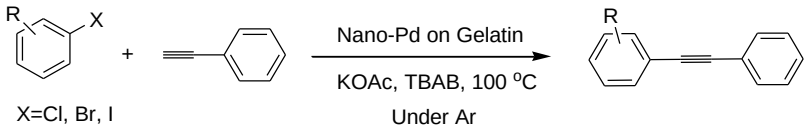
Scheme 1. [*Adv. Synth. Catal*. **2009**, *351*, 1925]

Synthesis of palladium nanoparticles supported on amino-functionalized clay has also been studied. The characterization of this catalyst was performed using XRD and UV-Vis spectroscopy as well as SEM and AFM images. The palladium content was determined by ICP analysis. We have successfully applied this material as a catalyst for Mizoroki-Heck reaction under solvent-free conditions at 130 °C (Scheme 2).



Scheme 2. [*Bull. Chem. Soc. Jpn.* **2011**, *84*, 100]

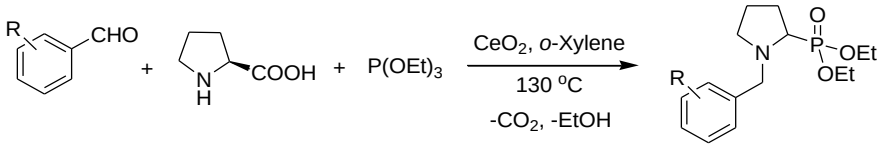
As the next try, palladium nanoparticles were deposited on the surface of gelatin. In this case, gelatin acts as an efficient reducing agent for the conversion of Pd(II) to Pd(0). This new supported Pd(0) has been used as a highly efficient catalyst for Sonogashira-Hagihara reaction in TBAB or PEG400 at 100 °C under argon atmosphere (Scheme 3).



Scheme 3. [*Org. Biomol. Chem.* **2011**, *9*, 865]

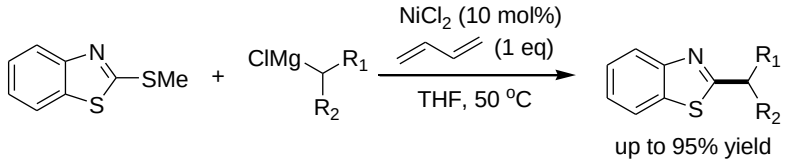
Moreover, this catalyst was applied for solvent-free Mizoroki-Heck reaction at 140 °C. Astonishingly, some of the reactions proceeded in the presence of this catalyst are among the fastest Mizoroki-Heck reactions ever reported in the literature. The kinetic study showed the important role of the in situ generated base adducts on the reaction rate.

In another study, a three-component reaction between aromatic aldehydes, α-amino acids and different nucleophiles such as nitro methane and triethyl phosphite has been reported (Scheme 4).



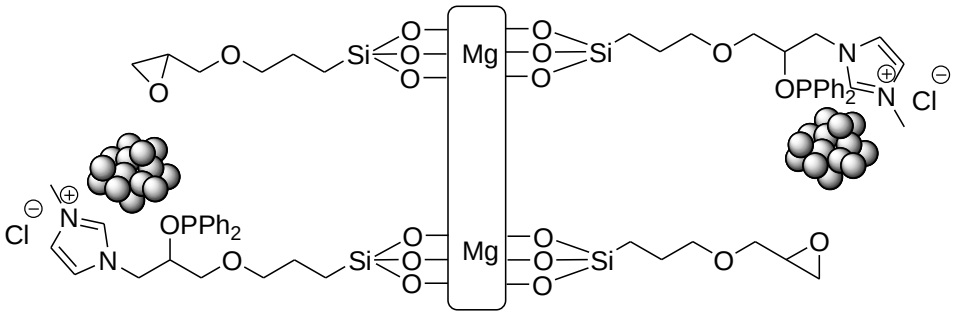
Scheme 4. [*Tetrahedron Lett.* **2012**, *53*, 5515]

In a different work, an efficient method for introduction of a secondary alkyl group into the 2-position of 1,3-thiazoles has been studied. Using $NiCl_2$/butadiene catalytic system for this reaction, the isomerization of the alkyl nucleophiles is suppressed, and the reduction of thioethers *via* β-hydrogen elimination is minimized (Scheme 5).



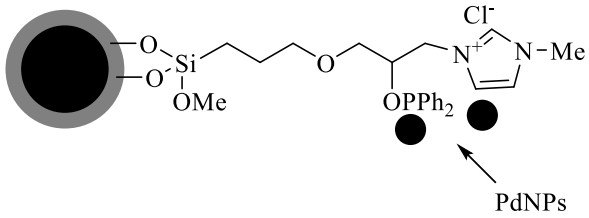
Scheme 5. [*Chem. Eur. J.* **2013**, *19*, 2951]

A new clay composite carrying phosphinite-functionalized ionic liquid moieties (CCPIL) has been designed and synthesized. Palladium nanoparticles were ligated by CCPIL uniformly (Scheme 6). After characterization, this composite has been applied as a heterogeneous catalyst for Suzuki-Miyaura, Sonogashira-Hagihara and Mizoroki-Heck reactions.



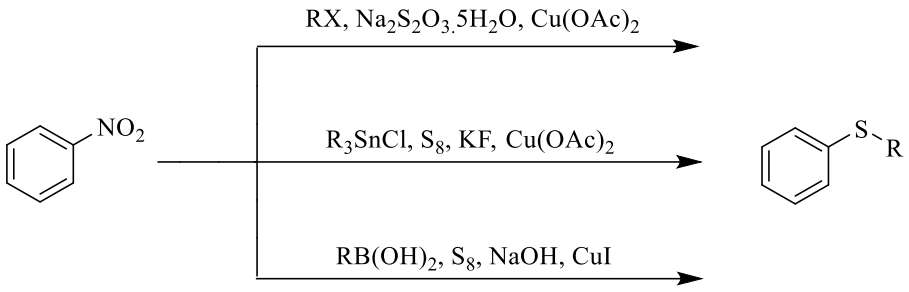
Scheme 6. [*RSC Adv.* **2014**, *4*, 27674]

Encouraged by the successful synthesis of this compound, we have prepared a magnetic composite using Fe_3O_4 nanoparticles carrying the same IL group. The obtained material was used as the catalyst in Suzuki-Miyaura reaction (Scheme 7).



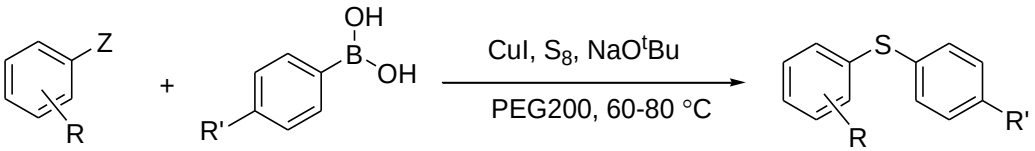
Scheme 7. [*Catal. Sci. Technol.* **2016**, *6*, 3117]

We have developed three efficient and odorless methods for the thioarylation of structurally diverse alkyl halides, arylboronic acids as well as triphenyltin chloride with nitroarenes using different sulfur sources catalyzed by copper salts (Scheme 8).



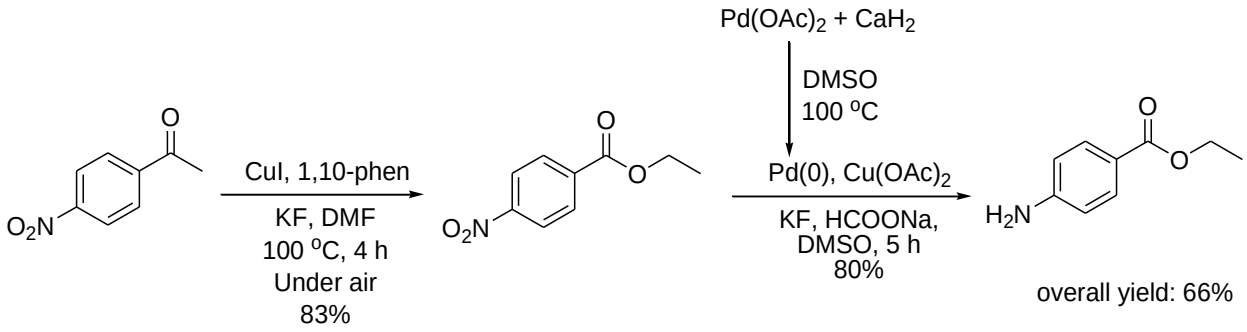
Scheme 8. [*J. Org. Chem.* **2015**, *80*, 8694]

In another attempt for the synthesis of unsymmetrical diaryl sulfides, we have developed efficient methodologies using the reaction of arylboronic acid as thiolating agents with phenolic compounds as the effective and available starting materials in the presence of S_8 *via* C-O bond activation (Scheme 9).



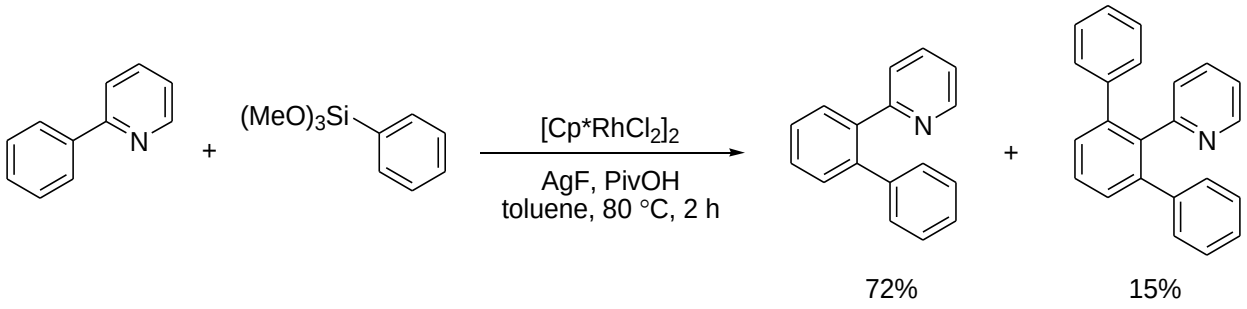
Scheme 9. [*Synthesis* **2017**, *49*, 5025]

We have also disclosed an efficient procedure for oxidative esterification of methyl ketones using copper as the catalyst in air. Our studies upon the plausible path of the reaction excludes the involvement of carboxylic acids and alcohols as the intermediates. Instead, it suggests that the aldehyde might be involved as the real intermediate. TEMPO-test shows that the reaction proceeds through a non-radical pathway. Using this procedure, we have synthesized benzocaine in a two-step reaction (Scheme 10).



Scheme 9. [*J. Iran. Chem. Soc.* **2019**, 16, 2327]

We reported a directed ortho-C-H arylation of 2-arylpyridienes using arylsilane derivatives as the coupling partner in the presence of Rh(III) and PivOH catalytic system. We have observed the significant assistance of a catalytic amount of pivalic acid upon the yield and therefore succeeded to obtain coupling products in good yields with high monoarylation selectivity under mild conditions and short reaction time (Scheme 10).



Scheme 10. [*Asian J. Org. Chem.* **2019**, 8, 1344]