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Issue 24; October 2018

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Recent Publications of ISHC Members

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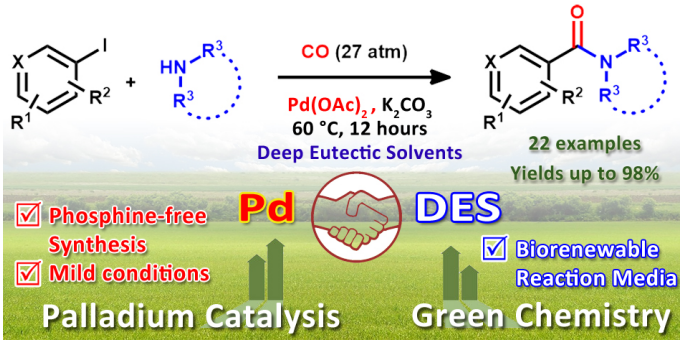
Towards a Sustainable Synthesis of Amides: Chemoselective Palladium-Catalysed Aminocarbonylation of Aryl Iodides in Deep Eutectic Solvents

Francesco Messa, Serena Perrone, Martina Capua, Francesco Tolomeo, Luigino Troisi, Vito Capriati, and Antonio Salomone

Chem. Commun. **2018**, *54*, 8100–8103. **DOI:** 10.1039/c8cc03858a

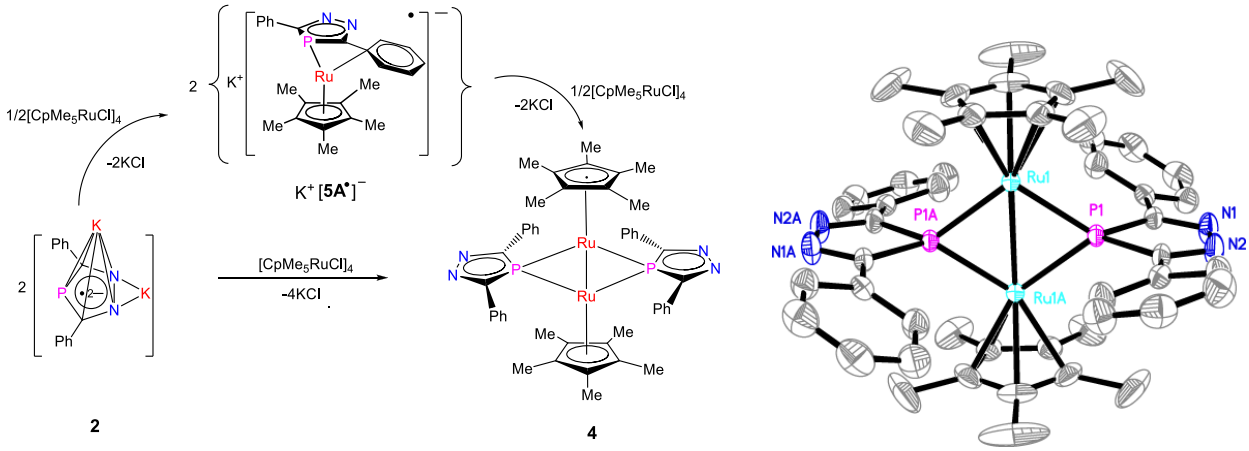


Abstract: A palladium-catalysed aminocarbonylation of (hetero)aryl iodides has, for the first time, been accomplished in deep eutectic solvents as environmentally benign and recyclable media, under mild conditions. The reactions proceeded with a good substrate scope, and a variety of amides have been synthesized in yields up to 98%.

A Dipotassium 1,2,4-Diazaphospholide Dianion Radical as an Organometallic Building Block: The First 1,2-Diaza-4-phosphine Ruthenocene

Xiang Zhang, Qiang Guo, Yuchen Zhang, Yaona Zhang, and Wenjun Zheng

Dalton Trans. **2018**, *47*, 13332–13336. **DOI:** 10.1039/c8dt03185a

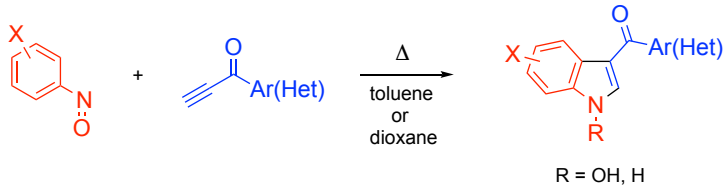


Abstract: A persistent dipotassium 3,5-diphenyl-1,2,4-diazaphospholide dianion radical $\{K^{+}_{2}[(3,5\text{-}Ph_2dp)]^{\bullet 2-}\}$ (**2**) was synthesized and investigated by EPR analysis and magnetic susceptibility measurement, and it can be used as a transfer agent for the preparation of an unusual 1,2-diaza-4-phosphine ruthenocene (**4**) with exclusive σ(P)-coordination. A plausible mechanism for the formation of **4** was proposed that involved a reactive radical intermediate $\{K^{+}[(\eta^5\text{-}CpMe_5Ru)(\sigma(P),\sigma(C)\text{-}(3,5\text{-}Ph_2dp)^{\bullet}]^{-}\}$ (K^{+}[**5A**$^{\bullet}$]$^{-}$) with σ(P)-coordination due to the high spin density (SD) at the phosphorus ($\sigma^2\lambda^3$) atom.

A Novel Synthesis of *N*-Hydroxy-3-aroylindoles and 3-Aroylindoles

Gabriella Ieronimo, Giovanni Palmisano, Angelo Maspero, Alessandro Marzorati, Luca Scapinello, Norberto Masciocchi, Giancarlo Cravotto, Alessandro Barge, Marco Simonetti, Keshav Lalit Ameta, Kenneth M. Nicholas, and Andrea Penoni

Org. Biomol. Chem. **2018**, *16*, 6853–6859. **DOI:** 10.1039/C8OB01471j

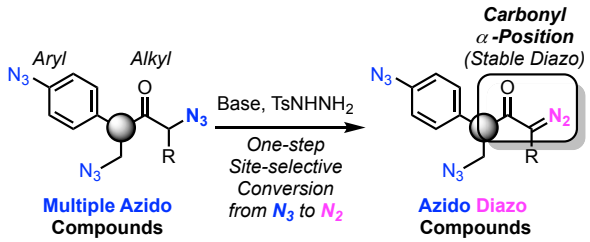


Abstract: A straightforward indole synthesis *via* annulation of *C*-nitrosoaromatics with conjugated terminal alkynones was realized achieving a simple, highly regioselective, atom- and step-economical access to 3-aroylindoles in moderate to good yields. Further functionalizations of indole scaffolds were investigated and an easy way to JWH-018, a synthetic cannabinoid, was achieved.

Site-Selective Conversion of Azido Groups at Carbonyl α-Positions to Diazo Groups in Diazido and Triazido Compounds

Taiki Yokoi, Hiroki Tanimoto, Tomomi Ueda, Tsumoru Morimoto, and Kiyomi Kakiuchi

J. Org. Chem. **2018**, *83*, 12103–12121. **DOI:** 10.1021/acs.joc.8b02074

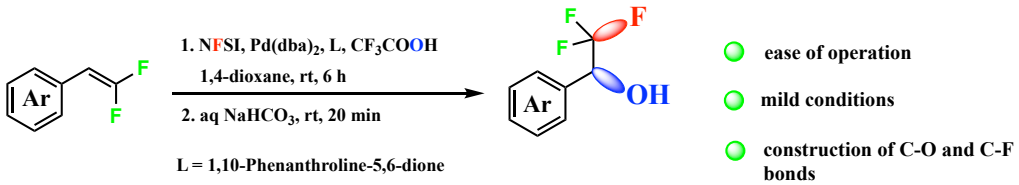


Abstract: This paper reports on the selective conversion of alkyl azido groups at the carbonyl α-position to diazo compounds. Through β-elimination of dinitrogen, followed by hydrazine formation/decomposition, α-azidocarbonyl moieties were transformed into α-diazo carbonyl groups in one step. As these reaction conditions do not involve aryl or general alkyl azides, site-selective conversions of di- and triazides were achieved. Through this method, the successive site-selective conjugation of the triazido molecule with three different components is demonstrated.

Palladium-Catalyzed Direct Approach to α-Trifluoromethyl Alcohols by Selective Hydroxylfluorination of *gem*-Difluoroalkenes

Bin Zhang, Xiaofei Zhang, Jian Hao, and Chunhao Yang

Eur. J. Or. Chem. **2018**, 5007–5015. **DOI:** 10.1002/ejoc.201800468

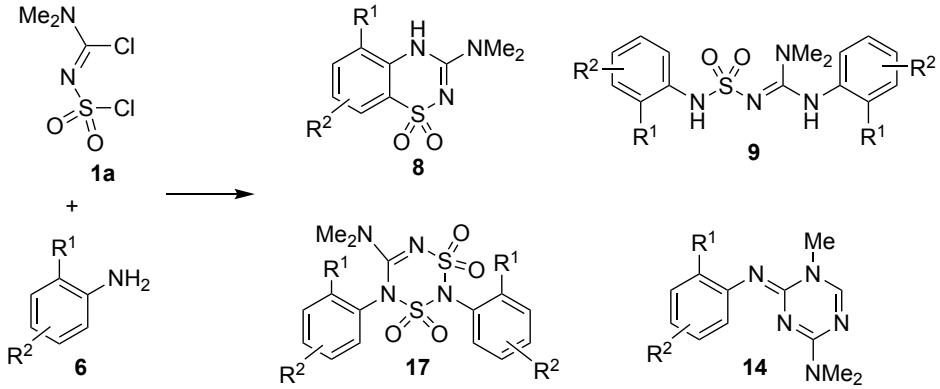


Abstract: A novel palladium-catalyzed selective hydroxylfluorination of *gem*-difluoroalkenes has been developed. By employing easily obtained *gem*-difluoroalkenes and NFSI as the fluorine source, the scope, advantages, and limitations of this reaction were well investigated. The reaction presents an efficient synthesis to afford a series of α-trifluoromethyl alcohols in good to excellent yields. Furthermore, this reaction probably proceeds via oxidation of Pd (0) to Pd (II) fluoride complex by NFSI, followed by fluoropalladation of *gem*-difluoroalkenes to generate an α-trifluoromethylbenzyl–Pd intermediate. This strategy offers more possibilities for the constructing of other bonds, such as C-C, C-N and C-

N,*N*-Dialkyl-*N*′-Chlorosulfonyl Chloroformamidines in Heterocyclic Synthesis. Part XV. Some Unexpected Reactions with Anilines

Dylan Innes, Michael V. Perkins, Andris J. Liepa, and Craig L. Francis

Aust. J. Chem. **2018**, *71*, 610–623. **DOI:** 10.1071/CH18252

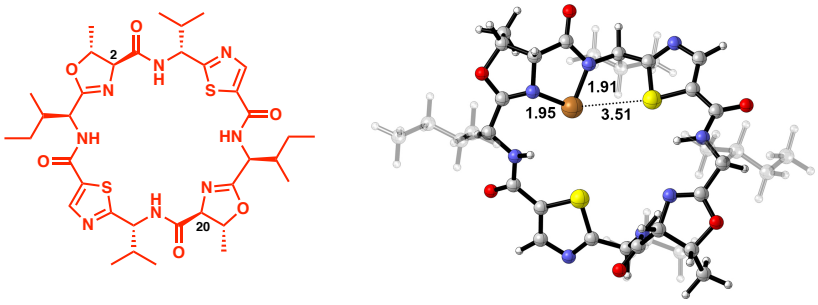


Abstract: *N*,*N*-Dimethyl-*N*′-chlorosulfonyl chloroformamidine **1a** underwent reactions with various anilines **6** to give the benzo[*e*][1,2,4]thiadiazine dioxides **8** and bis-anilino adducts **9**, along with some unexpected products, particularly when sterically hindered anilines were used. In such cases, the [1,3,2,4,6]dithiatriazine 1,1,3,3-tetraoxides **17** and, on occasion, the 4-(arylimino)-[1,3,5]triazin-2-amines **14**, were produced.

Developing Cyclic Peptide Heteroatom Interchange: Synthesis and DFT Modelling of a HI-Ascidiacyclamide Isomer

Sida Xie, Andrei I. Savchenko, Elizabeth H. Krenske, Rebecca L. Grange, Lawrence R. Gahan, and Craig M. Williams

Eur. J. Org. Chem. **2018**, 3265–3270. **DOI:** 10.1002/ejoc.201800449



HI-Ascidiacyclamide isomer (left) and corresponding calculated copper (II) complex (right)

Abstract: Tunicates that give rise to cyclic peptides have captured wide scientific attention, although mostly from ecological and drug discovery perspectives. It is for these reasons that cyclic peptides have attracted considerable synthetic intrigue, especially the azole type. As disclosed in this article the concept of heteroatom interchange (HI) was pursued using ascidiacyclamide. That is, the nitrogen and sulfur atoms of both thiazole rings within the HI-ascidiacyclamide system, were transposed via incorporation of thiazole-5-carboxamide units as opposed to the native thiazole-4-carboxamides. The synthesis of an HI-ascidiacyclamide isomer, along with a molecular-mechanics study of three-dimensional structure, in addition to copper-binding properties, was reported.

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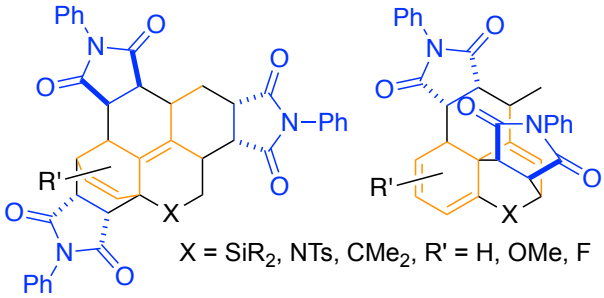
Cascade Multiple Diels–Alder Reactions of Styrene Derivatives with Maleimide or Maleic Anhydride

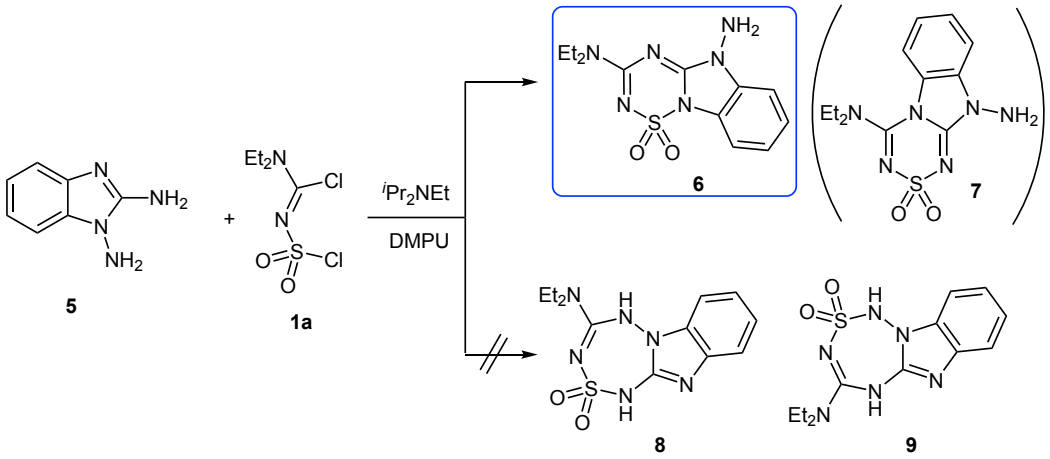
Shohei Yoshioka, Hiroshi Aoyama, Hiromichi Fujioka, and Mitsuhiro Arisawa
J. Org. Chem. **2018**, *83*, 6599–6606. **DOI:** 10.1021/acs.joc.8b00890



Abstract: We developed novel one-pot multiple Diels–Alder reactions, which are frequently used in the construction of six-membered rings in functional molecular synthesis. We report triple and double Diels–Alder reactions with styrene derivatives, where the secondary Diels–Alder reaction takes place at a different position from that of the conventional Wagner-Jauregg reaction.

5-Amino-3-(diethylamino)-5*H*-benzo[4,5]imidazo[1,2-*b*][1,2,4,6]thiatriazine 1,1-Dioxide

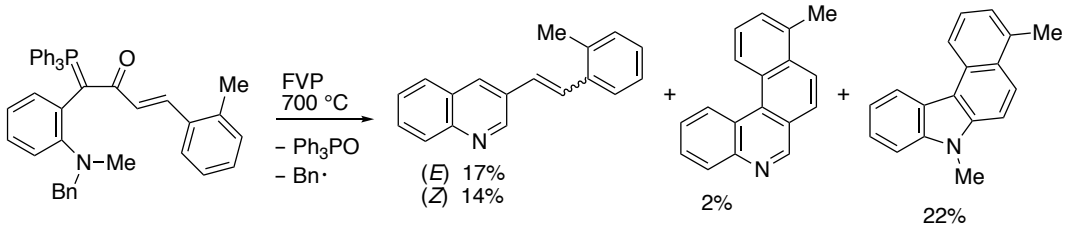
Victor Tran, Craig M. Forsyth, and Craig L. Francis
Molbank **2018**, *3*, M1018 (1–6). **DOI:** 10.3390/M1018



Abstract: In the quest for discovery of novel bioactive molecules, new heterocyclic ring systems provide templates for exploration of uncharted chemical space. Herein, we describe the synthesis of a new benzo[4,5]imidazo[1,2-*b*][1,2,4,6]thiatriazine derivative from readily available 1,2-diaminobenzimidazole and *N*,*N*-diethyl-*N'*-chlorosulfonyl chloroformamidine. The product structure, confirmed by X-ray crystallography, bears an exocyclic NH_2 group, which should enable synthesis of an extended range of derivatives of this unusual scaffold.

Further Studies on the Pyrolytic Domino Cyclization of Stabilized Phosphonium Ylides Bearing an *Ortho*-Aminophenyl Group

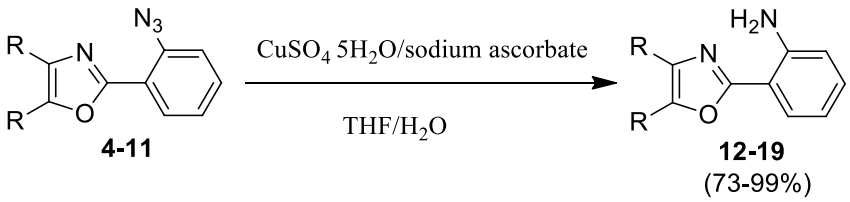
R. Alan Aitken, Lorna Murray, and Alexandra M. Z. Slawin
Molecules **2018**, *23*, 2153-1–2153-12. **DOI:** 10.3390/molecules23092153



Abstract: Four new stabilized phosphonium ylides containing a 2-(benzyl(methyl)amino)phenyl group have been prepared and characterized and are found, upon pyrolysis under gas-phase flow conditions, to lose Ph_3PO and benzyl radical to afford new heterocyclic products resulting from domino cyclization of both *C*- and *N*-centered radicals. Most products arise from processes of the former type and have quinoline, phenanthridine or ring-fused phenanthridine structures, while in one case a process of the latter type leads to a benzocarbazole product. The X-ray structure of a 2-(methyl(tosyl)amino)phenyl ylide is also reported.

Alternate Pathway for the Click Reaction of 2-(2-Azidophenyl)-4,5-diaryloxazoles

Pravin C. Patil and Frederick A. Luzzio
Tetrahedron Lett. **2018**, *59*, 3458–3460. **DOI:** 10.1016/j.tetlet.2018.07.062



Abstract: The $CuSO_4$/ascorbate-mediated 'click' reaction of 2-(2-azidophenyl)-4,5-diaryloxazoles and arylacetylenes proceeded through an alternate pathway whereby reduction of the azide predominated over formation of the 1,2,3-triazole-forming cycloaddition. The unimolecular product, 2-(2-aminophenyl)-4,5-diphenyloxazole, was isolated which appears to be a formal reduction of the arylazide to the corresponding arylamine. A series of oxazoles which possessed various substituents (F, Cl, Br, OCH_3) on the 4,5-diaryl rings and having the 2-azido group on the 2-oxazolylphenyl position were submitted to the same 'click' conditions and gave the corresponding arylamine products (73–99%). The reaction appears to be specific toward the ortho-azido substitution of the polycyclic system, as the corresponding azidomethyl-substituted phenyl oxazoles do not give the 'reduction' products but gave the expected click products with the acetylenic co-reactants.