HYDROGEN PRODUCTION FROM FORMIC ACID CATALYZED BY NOVEL RUTHENIUM PYRIDYL-FORMAMIDINE COMPOUNDS

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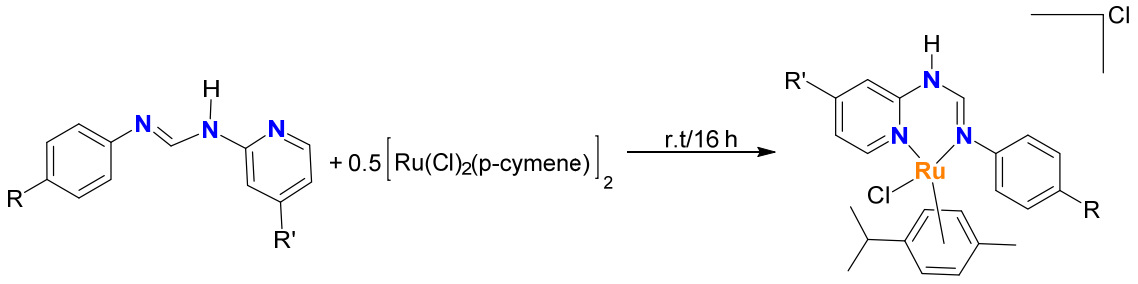
Hydrogen (H_2) is receiving an increased amount of attention as an alternative energy carrier and a potential fuel of the future because it is a clean fuel, and the burning of hydrogen does not result in harmful emissions. [1]. Even though H_2 is a promising alternative energy source, there are a few problems associated with the use of hydrogen: H_2 is a light gas at ambient conditions which makes it very expensive to store. There is a need for a practical, economical and safe method to store, handle and transport the produced hydrogen. A solution to this problem is using liquid organic compounds such as ammonia, alcohols, cyclohexane, formic acid (FA), etc as a chemical store for hydrogen. [2] FA is attractive as a potential hydrogen carrier due to its superior physicochemical properties and low toxicity for convenient handling, transportation and storage. Additionally, FA can be reversibly generated by hydrogenation of carbon dioxide and subsequently dehydrogenated, thus making it an attractive carrier candidate. [3] Efforts at Formic acid dehydrogenation (FADH) under mild conditions employed precious metals such as Ru, Ir and Rh with various ligand systems. However, there are no reports on using pyridyl-formamidine ligand systems in these transformations. Herein we report novel pyridyl-formamidine ligands and their corresponding Ruthenium(II) complexes (Scheme 1) as precatalysts for FADH.



R = CH_3, OCH_3, H, NO_2

R' = CH_3, OCH_3, H

Scheme 1: Synthesis of novel pyridyl-formamidine Ruthenium(II) complexes

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[2] Alberico, E.; Sponholz, P.; Cordes, C.; Nielsen, M.; Drexler, H. J.; Baumann, W.; Junge, H.; Beller, M., Angew. Chem. Int. Ed. 2013, 52 (52), 14162-14166.

[3] Léval, A.; Agapova, A.; Steinlechner, C.; Alberico, E.; Junge H.; Beller M., Green Chem., 2020, 22, 913–920