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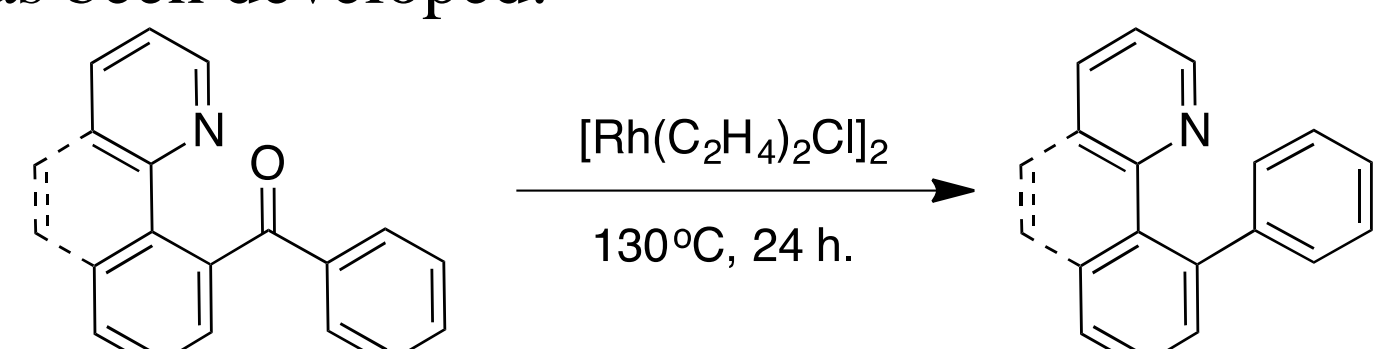
The Effect of Directing Groups and Various Substituents on Rhodium Catalyzed Decarbonylation

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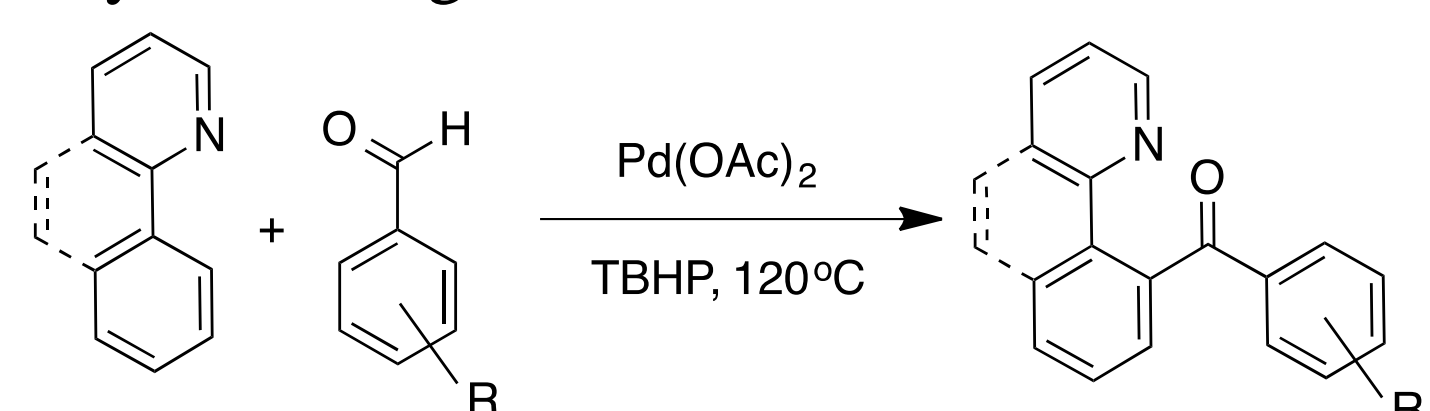
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Background Information

The activation of carbon-carbon single bonds is difficult due to their nonpolar nature and kinetic stability. The ability to functionalize these bonds can lead to new methodologies valuable in synthetic pathways. Recently, a new method for decarbonylation of aryl ketones via rhodium catalysis has been developed.¹

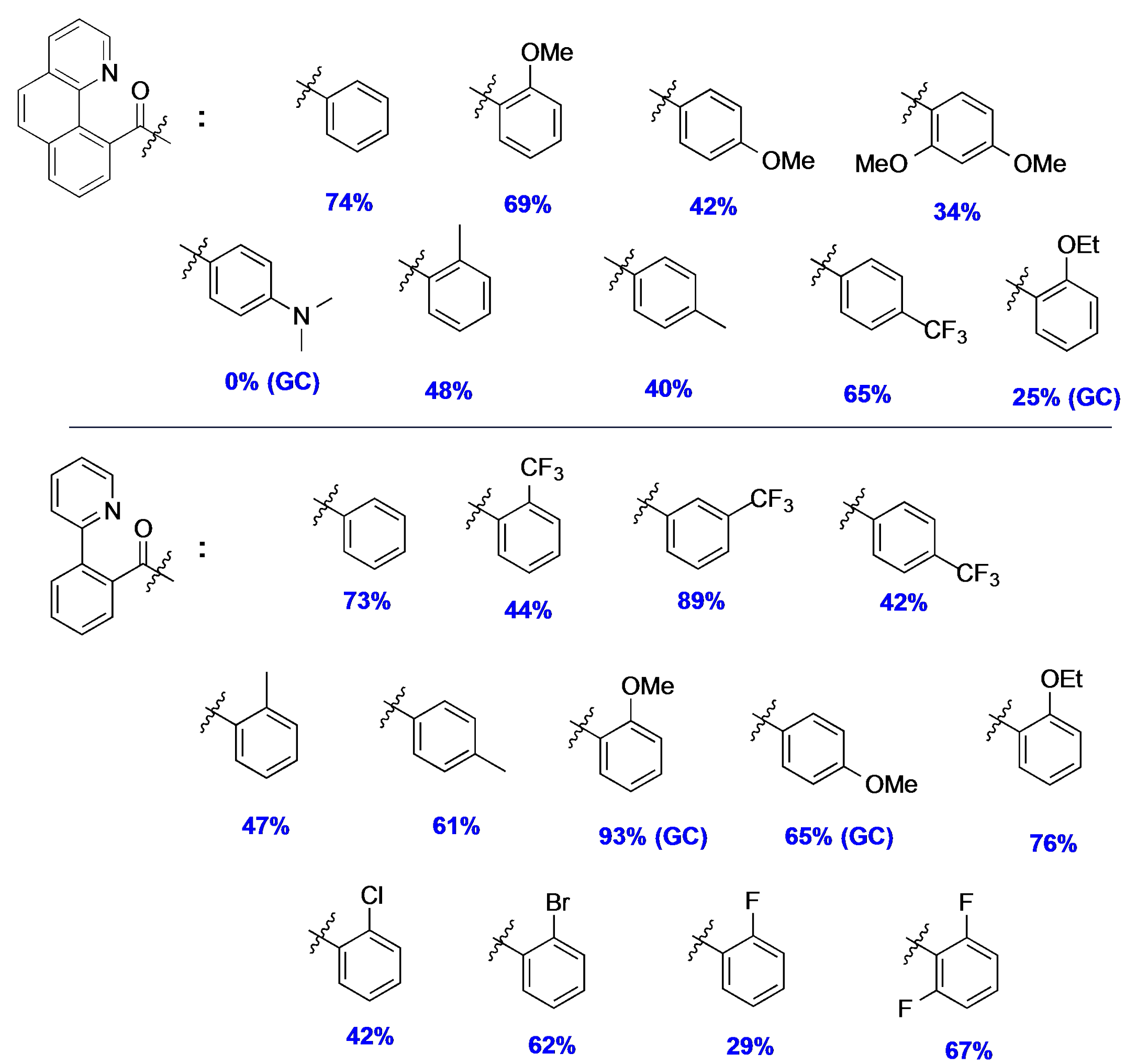


This study examines the carbon-carbon bond activation of compounds using nitrogen directing groups. A palladium catalyzed carbon-carbon coupling reaction² was utilized and improved upon for the purpose of creating a variety of starting materials.

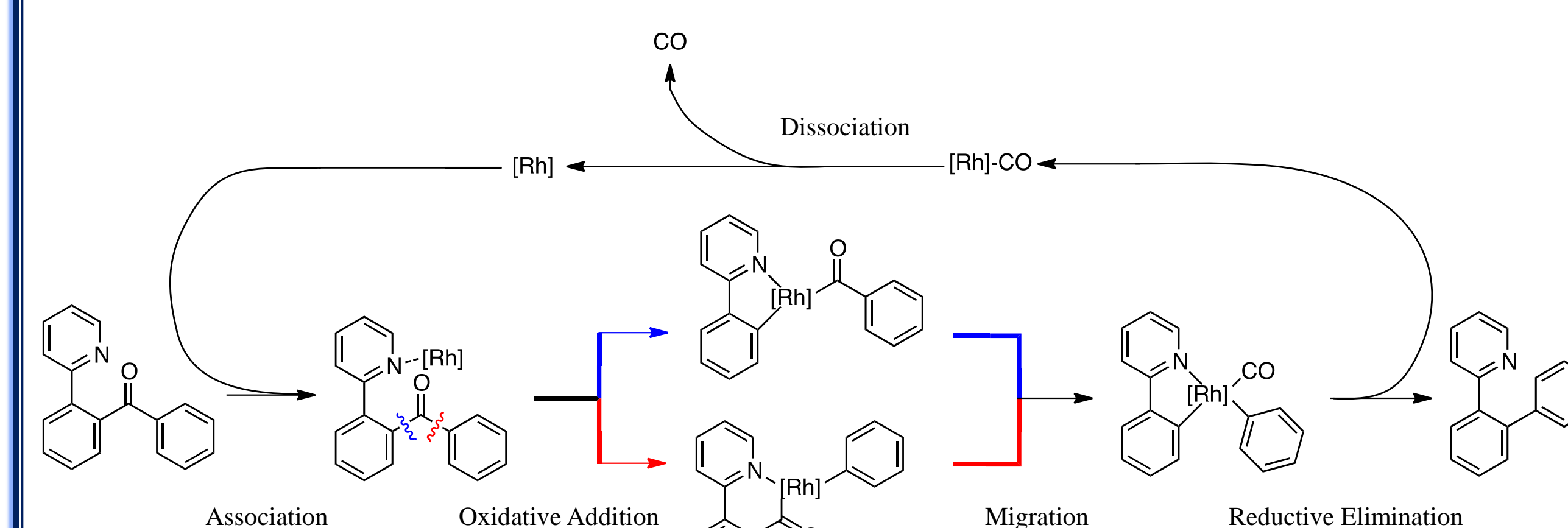


These species are being used to explore the mechanism of the rhodium catalyzed decarbonylation reaction.

Scope of Substrates

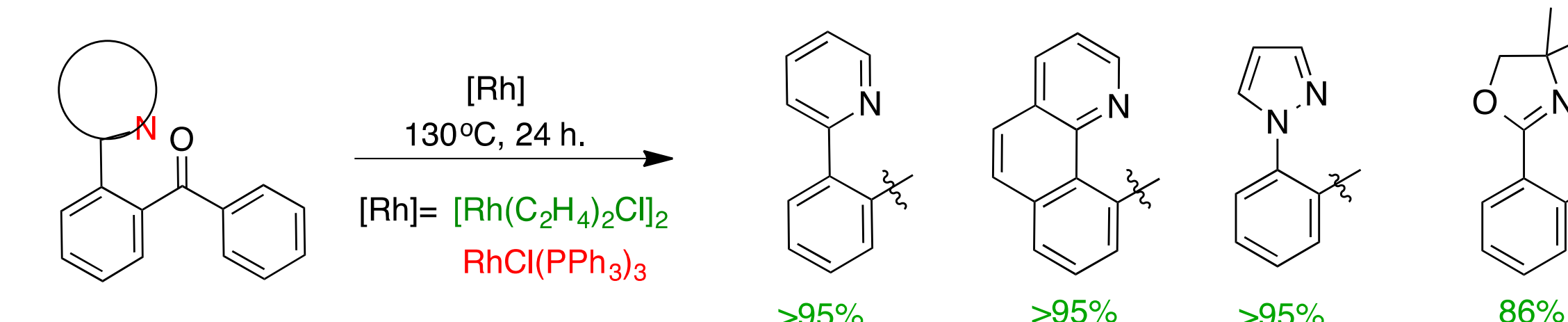


Proposed Catalytic Cycle



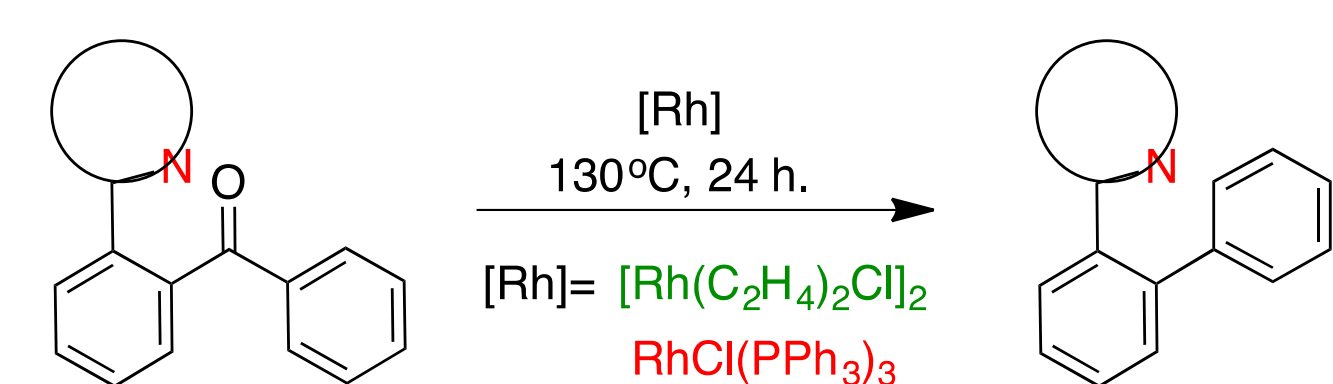
The oxidative insertion of rhodium can occur on either side of the carbonyl as shown by the two intermediates. Studies are underway to determine the active pathway.

Directing Group Decarbonylation Results

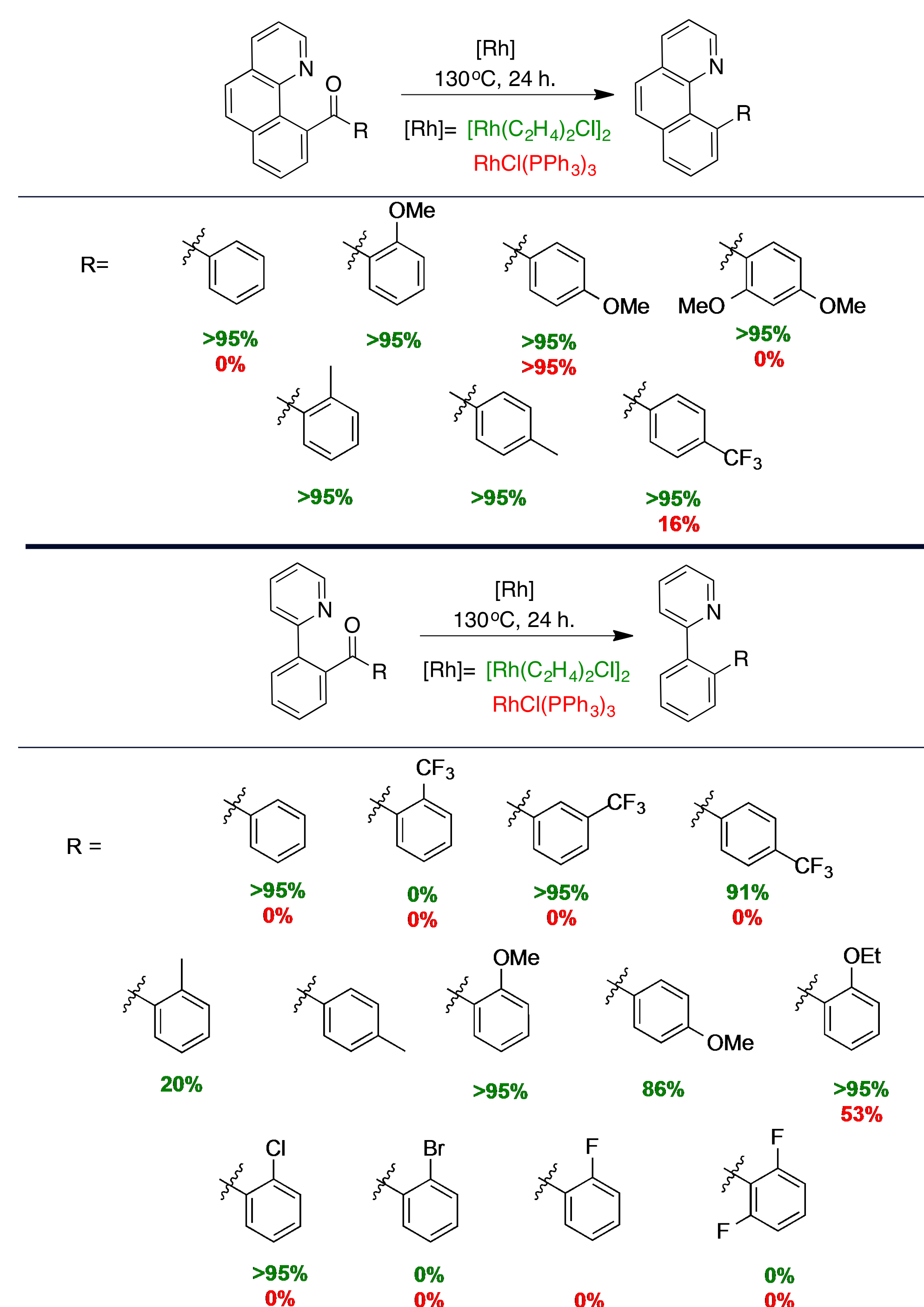


Directing Effects

Nitrogen donates electrons to the rhodium metal center allowing catalytic conversion from the carbonylated species to the final decarbonylated species. Different nitrogen-containing directing groups and substrates were tested for effectiveness in this decarbonylation reaction.

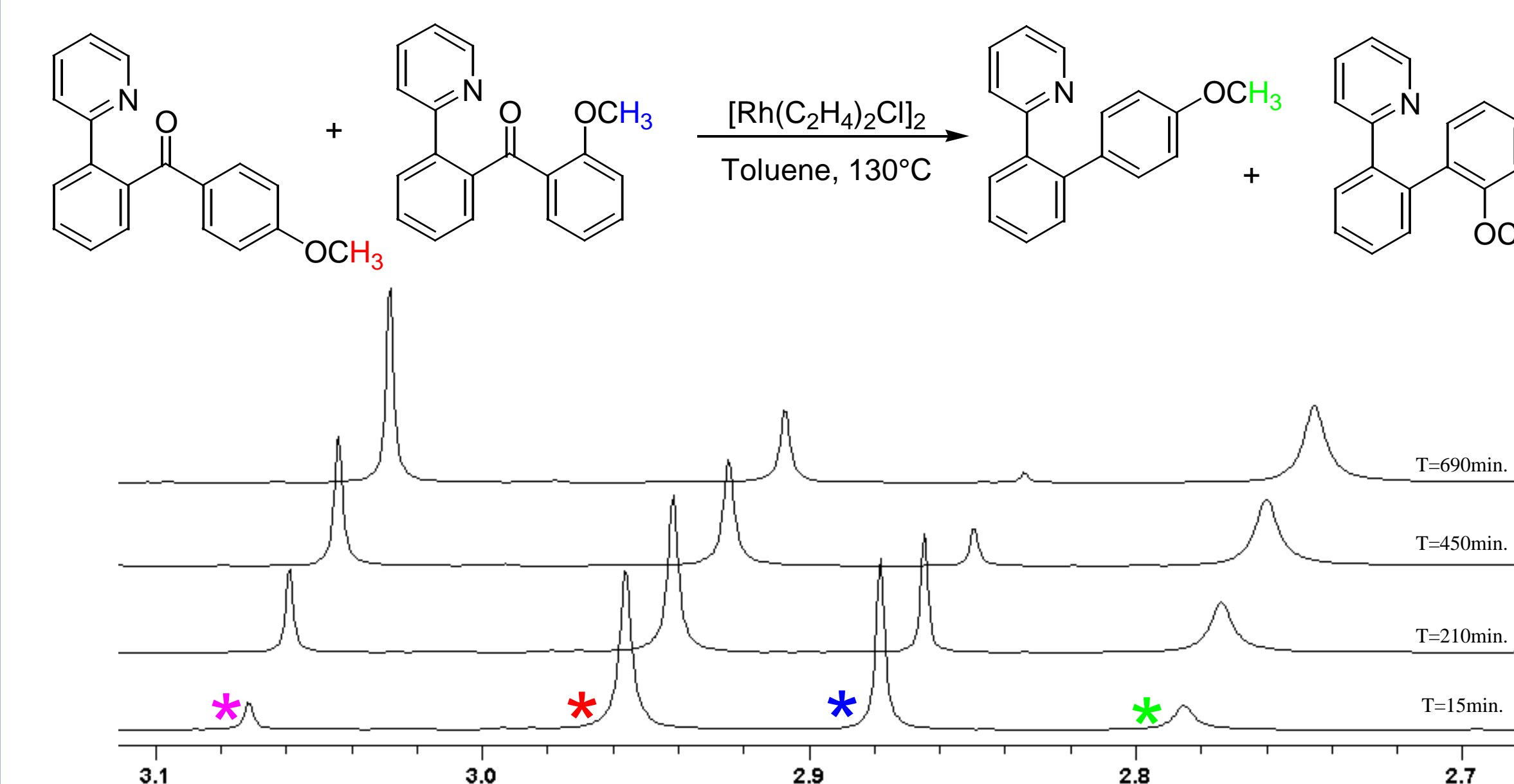


Decarbonylation Results

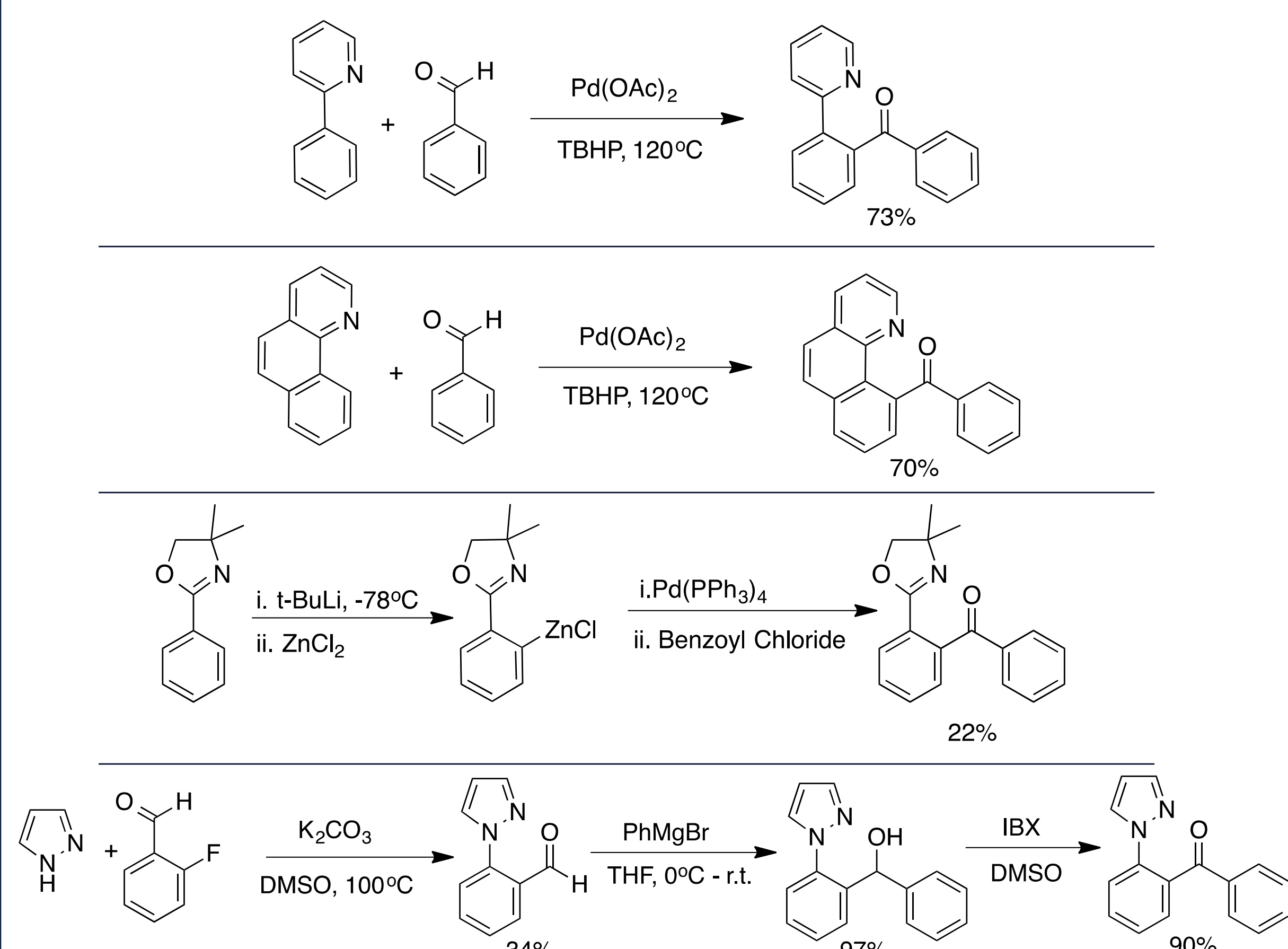


Conclusions and Future Work

Continued research will focus on the synthesis of diverse starting materials to be used in the rhodium catalyzed decarbonylation reaction. Competitive reactions between starting materials will compare the reaction rates as influenced by the characteristics of the substituents. This will be monitored throughout the reaction by ¹H NMR spectroscopy as shown in the example below.



Substrate Synthesis



The directing groups were synthesized as shown. They were used as a precursor to the chlorobis(ethylene)rhodium(1) dimer or Wilkinson's catalyzed decarbonylation.

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References

1. Lei, Z.-Q., Li, H., Li, Y., *Angew. Chem. Int. Ed.*, 2012, 51: 2690-2694.
2. Baslé, O., Bidange, J., Shuai, Q., Li, C.-J. *Adv. Synth. Catal.*, 2010, 352: 1145-1149.
3. Evans, P. A., Nelson, J. D., Stanley, A. L., *J. Org. Chem.*, 1995, 60: 2298-2301.

