

# NKU Synthesis of a *bis*-bipyridine ligand for linear multi-metallic chains

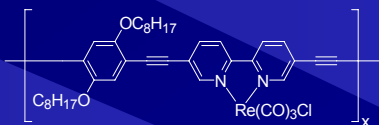


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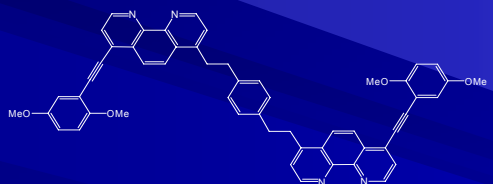
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**Objective:** The purpose of this research project is to synthesize a new organometallic supramolecular system that will efficiently move charge when excited by light.

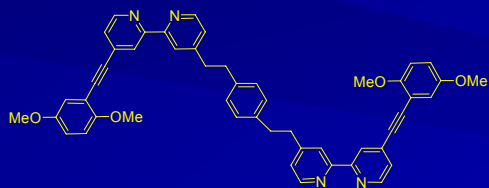
**Background:** Many researchers<sup>1-4</sup> have explored polymers with pendant transition metal complexes. When interacted with light, the polymer and transition metal tend to act independently of each other.



Our solution is to incorporate the transition metal directly into the backbone of a ligand inspired by Sauvage<sup>5</sup> and react it with light to see if there are improvements over current systems. Previously, Sarah Beetem\* and Kelly Lawson-Ferguson\* have worked on synthesizing a ligand based on a phenanthroline system. The synthesis involves multiple steps, some of which are difficult to accomplish.

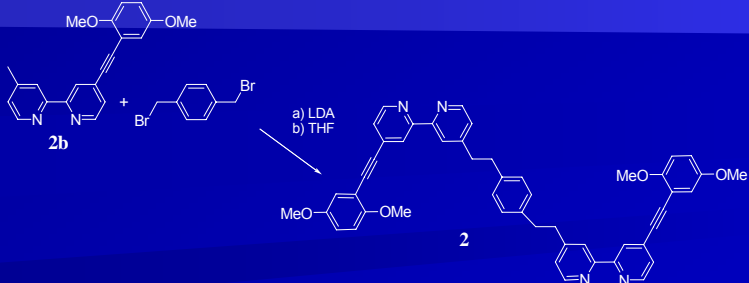
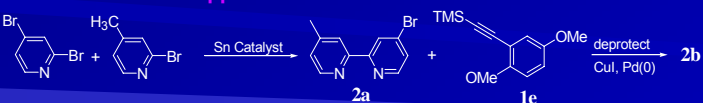


The goal is to synthesize a ligand that is based on a bipyridine structure. This trans-directing linear ligand will incorporate the transition metal directly into the backbone of the photochemically active polymer. In addition, it will require fewer synthetic steps.



## Bis-bipyridine Ligand Synthesis

“Outside - In” Approach:



## Step 1 – Synthesis of 4-bromo-4-methylbipyridine

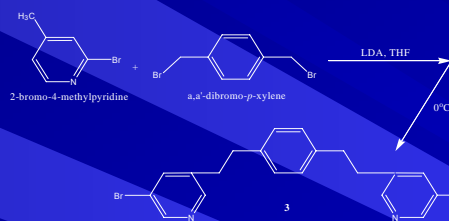


Attempted, but no successful syntheses.

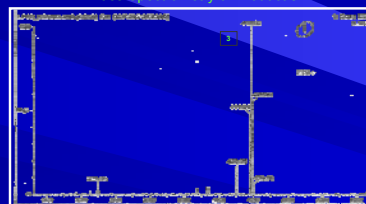
Purple color of product suggested that molecular bromine was produced.

“Inside – Out” Approach:

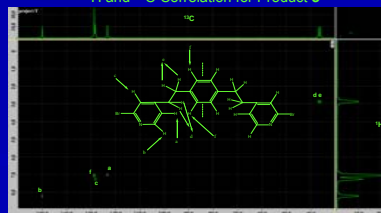
## Step 1 – Synthesis of Product 3



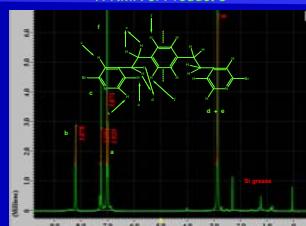
## Mass Spectrometry of Product 3



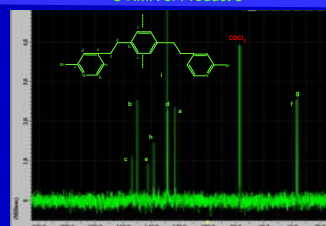
## <sup>1</sup>H and <sup>13</sup>C Correlation for Product 3



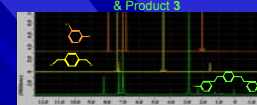
## <sup>1</sup>H NMR of Product 3



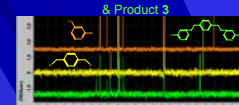
## <sup>13</sup>C NMR of Product 3



## <sup>1</sup>H NMR of starting materials & Product 3



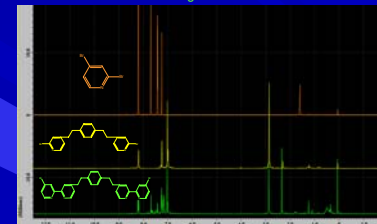
## <sup>13</sup>C NMR of starting materials & Product 3



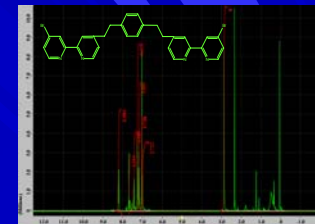
## Step 2 – Synthesis of Product 4



## <sup>1</sup>H NMR of starting materials & Product 4



## <sup>1</sup>H NMR of Product 4



## Step 3 - Synthesis of Product 5



Future Steps:

- Deprotect Product 5 & react with Product 4, forming bis-bipyridine ligand
- Incorporate transition metal into bis-bipyridine ligand
- Carry out detailed photochemical & photophysical studies on bis-bipyridine ligand
- Make applications in solar cell development, molecular devices, and computer technology

## Acknowledgments

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## References

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