Two VB transition metal compounds, $\text{C}_5\text{H}(\text{C}_6\text{H}_5)_4\text{NbCl}_4$ (1) and $\text{C}_5\text{H}(\text{C}_6\text{H}_5)_4\text{TaCl}_4$ (2), and the trimethyltin monohapto compound $\text{C}_5\text{H}(\text{C}_6\text{H}_5)_4\text{Sn(CH}_3)_3\text{Cl}$ (3) were synthesized and characterized by $\text{H}$ and $\text{C}$-NMR. The purple-brown niobium complex and the tantalem homologue were synthesized in 46% and 50% unoptimized yields, respectively, while the preparation of tin compound gave crude yield of 54% Complexes 1 and 2 display identical $\text{H}$-NMR, $\delta_{\text{H}}$(CDCl$_3$): 6.56 – 7.51 ppm (20H, m) and 4.68 ppm (1H, s) and similar $\text{C}$-NMR, $\delta_{\text{C}}$(CDCl$_3$): 144.9 ppm (q), 137.8 ppm (q) and 129.4 ppm (m). For compound 3 $\delta_{\text{C}}$(CDCl$_3$): 6.87 – 7.35 ppm (20H, m), 5.02 ppm (1H, $J_{\text{H}-\text{H}}$ = 88 Hz) and 0.19 ppm (1H, $J_{\text{H}-\text{H}}$ = 52 Hz) and $\delta_{\text{C}}$(CDCl$_3$). The transmetalation of 3 with NCSi led to 4. The Lewis acid catalysis of the silylcyanation of butyraldehyde using 1 was monitored via $\text{H}$-NMR.

**Results and Discussion**

The original synthesis design for 1 and 2 was via the transmetalation of 3 with the corresponding chloride salt. Experimentation and failed attempts using this scheme led to the discovery that the reaction would proceed using just dienide with either of the metal salts. What is essential to this step is the quality of the dienide used. Once this was learned, we observed that the complexation reaction via the TMSiD intermediate yields the niobium complex, leading to expectations that the tantalum complex can also be synthesized by this pathway. It is also both interesting and exciting that we are potentially able to synthesize both metal complexes and by two different methods. Figures 1, 2 and 3 display the NMR spectra of the mentioned compounds. As it can be seen in these figures the $\text{H}$ and $\text{C}$-NMR for the niobium and tantalum complexes is strikingly similar. They both display similar aromatic effects of 5, dry CDCl$_3$: singlets at -0.19 ppm and 5.05 ppm and a characteristic singlet at 4.68 ppm for the proton NMR ($\delta_{\text{H}}$(CD$_3$CN)) while the $\text{C}$ spectra shows multiplets at about 130, 138 and 145 ppm ($\delta_{\text{C}}$(CDCl$_3$)). The once elusive tin complex is characterized by the presence of two singlets and their satellites in both the $\text{H}$ and $\text{C}$-NMR. ($\delta_{\text{H}}$(CD$_3$CN)) singlets at -0.19 and 5.05 ppm and ($\delta_{\text{C}}$(CDCl$_3$)) singlets at -0.34 and 5.47 ppm. The use of different solvent for the synthesis of 1 led to a cleaner $\text{H}$-NMR ($\delta_{\text{H}}$(CDCl$_3$)) with the characteristic singlet at 4.72 ppm (Fig 5). Although the transmetalation reaction led to several products one of them seems to be the desired niobium product as can be seen in Figure 4. Tables 1 through 4 display all the NMR numerical data. The catalytic effects of 4 are clearly seen in Figures 6 through 8. The silylcyanation of butyraldehyde proceed at a faster rate with the catalyst then without it.

**Future Work**

The next step is to successfully recrystallize the tin, niobium, and tantalum complexes in order to perform elemental analysis and to further elucidate the structure of our compounds. The synthesis of the tantalum complex using TMSiD will also be explored, and the synthesis of the niobium complex by this pathway will be optimized. The catalytic activities of the niobium as well as the tantalum complexes will be further investigated.

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