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Syntheses and reactivity of polymethylated ferrocenes: Electrophilic addition to heptamethylferrocene

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Being able to attend the ACS conference was a fantastic experience overall. During my presentation, I spoke with a number of chemists both within and outside of my area of interest, all of whom asked me interesting and insightful questions about my project. I felt as though I could give a very good walkthrough of my poster by the end of the session. During other poster sessions, I spoke with students at graduate schools that I am applying to about their research, as well as about the programs. I attended talks given by SU professor Dr. Doug Latch, as well as his collaborator at the USGS, about innovations to the analytical chemistry curriculum. Having been in the first class to get this new curriculum, their talks gave me a lot of insight into the considerations they made designing it and how they directly benefitted my learning. I believe that this was of great benefit to my career aspirations and I'm thankful that I got to share some of the research being conducted within Seattle U's Chemistry Department with the broader chemistry community, and discuss our discoveries with experts.

The image shows a young man with glasses and a red patterned shirt standing next to a large chemistry poster. The poster is titled "Syntheses and reactivity of polymethylated ferrocenes: Electrophilic addition to heptamethylferrocene" and is from Seattle University. The poster is divided into several sections: Introduction, Background & Purpose, Methods, Isomers of heptamethylferrocene, Me₇Fc, UV-vis Spectroscopy, Electrophilic Addition, and Electrochemistry. The poster includes chemical structures, graphs, and text describing the research. The student is wearing a lanyard with a badge that reads "CHANCE JELLINEK" and "SEATTLE UNIVERSITY".

Syntheses and reactivity of polymethylated ferrocenes: Electrophilic addition to heptamethylferrocene
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Introduction
 Multi-decker organometallic complexes have unique structural, optical, and electrochemical properties associated with metal-metal communication mediated by an organic bridging ligand. Potential applications include linearly organometallic sandwich molecular wires (BOGAMs).

Background & Purpose
 Prior work established that electrophilic addition of Fc^+R^- to polymethylated ferrocenes with eight (or more) methyl group substituents produced stable triple-decker ferrocenyl complexes (right arrow), but addition of Fc^+R^- to ferrocene derivatives with less (or fewer) methyl group substituents led only to ring saturation (left arrow).

Methods
 An allyl-type group was introduced to 1,1'-dimethylferrocene using a modified Vilsmeier-Haack reaction. Subsequent hydrogenation with borane afforded trimethylferrocene in good yield. Two structural isomers of trimethylferrocene, Me_3Fc , were produced: major isomer 1,3,1' (88%) and minor isomer 1,2,1' (22%).

Isomers of heptamethylferrocene, Me_7Fc
 Repeated use of the formylation and hydrogenation reactions afforded the complete series of polymethylated ferrocenes from trimethylferrocene to heptamethylferrocene (below).

UV-vis Spectroscopy
 Normalized absorption spectra of Fc to Me_7Fc . Addition of methyl group substituents brings a shift for the d-d transition.

Electrophilic Addition
 Electrophilic addition of manganese and ruthenium to heptamethylferrocene formed bimetallic complexes.

Electrochemistry
 Normalized cyclic voltammetry (CV) traces for the complete series of polymethylated ferrocenes using ferrocene as an internal standard. The addition of methyl group substituents brings about a cathodic shift for the Fc^+Fc^- couple.

Plot of potential vs degree of methylation. Newly synthesized compounds in blue, commercially available in red. The average cathodic shift is ca. 54 mV per methyl group.