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Organometallic complexes contain a metal and one or more groups of atoms, called ligands, bound to it through carbon-to-metal bonds. They are important because they are used in industry to catalyze the synthesis of more complex, and valuable, products from simpler, cheaper, starting materials. Understanding how these compounds react and what can be done to make them more reactive can make them more useful. One generally accepted rule for organometallic compounds is that they are most stable when the metal contains 18 electrons in its outermost orbitals. But compounds that are stable, by definition, do not react. In order to catalyze important conversions, the compounds must be made to react. One way to make organometallic compounds more reactive is to change the number of electrons in the metal's orbitals. This result can be achieved through chemical reactions called redox reactions, which involve the transfer of electrons. These reactions can also be studied by analytical instruments using various electrochemical techniques.

One of the most active catalytic metals is rhodium. Despite its high cost (much more expensive than gold), rhodium is used in some large-scale industrial reactions, such as the conversion methyl alcohol to acetic acid. The key step in this reaction is the insertion of a molecule of carbon monoxide into a rhodium-carbon bond. Understanding this reaction and its reverse can perhaps help us to develop less expensive and/or more efficient catalysts for this important type of reaction. This project seeks to study the reactivity of a group of rhodium compounds with especially stable Rh-C bonds. By adding or subtracting electrons we can make these compounds more reactive. Investigating the factors which affect the reactivity of these compounds may help in understanding the reactivity of less expensive metals such as cobalt and thus pave the way for their use in place of rhodium catalysts.