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Carbon nitrogen bonds can be formed by the action of transition metals in a variety of reactions. Ligands containing C-N bonds can be made by the reaction of appropriate reagents. Metal complexes can also stoichiometrically and catalytically form C-N bonds in organic compounds.

NO reacts with d⁰ metal alkyls to form N-alkyl-N-nitrosohydroxylaminate compounds [1]. The mechanism of the reaction is believed to involve free radicals [2]. NO coordinated to more electron rich low oxidation state metals can react with free or attached organic moieties to form nitriles, imides and oximes [3]. The addition of methyliodide to the cyclopentadienylnitrosylcobalt anion in the presence of phosphine results in the formation of cyclopentadienyl-(nitrosomethyl)trialkylphosphinocobalt. With triphenylphosphine the reaction mechanism is similar to that observed for alkyl migration to coordinated CO. Triethylphosphine, a more basic phosphine, is found to inhibit the reaction [4]. NO⁺ can attack coordinatively saturated monomers and clusters [5].

Cobalt and nickel compounds are known to catalyze the coupling of acetylene with nitriles and isocyanates to form, respectively, pyridines and 2-pyridones [6]. The reaction proceeds by initial coupling of acetylene with the nitrogen containing compound to form a metallacycle which reacts further with another equivalent of acetylene to form the product [7]. N-alkyl aziridines react with CO in the presence of [Rh(CO)₂Cl]₂ to form β -lactams [8]. Nitrobenzene will also react with CO and ROH in the presence of triiron and triruthenium dode-carbonyl to form carbamates [9]. Several bis(μ_3 -imido)triiron and triruthenium carbonyl clusters have been synthesized that could serve as models for the intermediate [10].

Several examples exist where carbon nitrogen bond formation has been used to study processes of biological interests. Tosylimide form aziridines when reacted with 1,1 and 1,2 diphenyl alkenes in the presence of $Fe^{III}(TPP)Cl$. The reaction is stereospecific but not stereoselective [11]. Vinylidene carbene iron porphyrin complexes can be oxidized to give a compound where the carbon atom is bound both to iron and the nitrogen on the porphyrin ring. These compounds have been suggested as models for the structure of the iron oxo porphyrin radical cation [12]. Dinitrogen in $W(N_2)_2(dppe)_2$ can be alkylated and electrochemically reduced [13].

There are several other processes where nitrogen bonds are formed. Amines can be transalkylated by Ru, Os, Rh, and Ir carbonyl clusters [14]. The reaction is though to proceed by a carbene intermediate [15]. Metal nitrides can be alkylated by a variety of electrophiles. In the case of coordinatively saturated d⁰ species, such as $Mo(N)(S_2CNR_2)_3$, attack occurs directly at the nucleophilic nitrogen [16]. With d², 16e⁻ compounds, electrophilic attack might occur at either nitrogen or the metal [17]. Ammoxidation, an industrially important process where propylene is converted to acrylonitrile by Bi₂Mo₃O₁₂ or Fe-Sb-O_x, is thought to proceed with the generation of an allylic free radical [18]. Attempts have been made to model this process with homogeneous systems [19].

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