

# C–H Bond Activation of Methane with Gaseous $[(\text{CH}_3)\text{Pt}(\text{L})]^+$ Complexes (L = Pyridine, Bipyridine, and Phenanthroline)

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Electrospray ionization of solutions of dimethyl(1,5-cyclooctadiene)platinum(II) in methanol with traces of nitrogen-containing ligands L provides gaseous complexes of the type  $[(\text{CH}_3)\text{Pt}(\text{L})]^+$  with L = pyridine (py), 2,2'-bipyridine (bipy), and 1,10-phenanthroline (phen). These  $[(\text{CH}_3)\text{Pt}(\text{L})]^+$  cations are capable of activating the C–H bond in methane as shown by H/D exchange when using  $\text{CD}_4$  as a neutral reactant. Most reactive is the complex  $[(\text{CH}_3)\text{Pt}(\text{py})]^+$  bearing a monodentate nitrogen ligand. The cationic complexes  $[(\text{CH}_3)\text{Pt}(\text{bipy})]^+$  and  $[(\text{CH}_3)\text{Pt}(\text{phen})]^+$  also bring about activation of methane, though at a lower rate, whereas the bipyridine complex  $[(\text{CH}_3)\text{Pt}(\text{py})_2]^+$  does not react with methane at thermal conditions. A detailed analysis of the experimental data by means of kinetic modeling provides insight into the underlying mechanistic steps, but a distinction whether the reaction occurs as  $\sigma$  bond metathesis or *via* an oxidative addition cannot be made on the basis of the experimental data available.

**Key words:** C–H Bond Activation, Electrospray Ionization, Mass Spectrometry, Methane, Platinum