Zero electron kinetic energy (ZEKE) photoelectron spectroscopy was used to study the electronic spectra of metal-diammonia and its deuterated species. The adiabatic ionization potential of the copper complex was measured to be 29532 cm$^{-1}$, a shift of more than a factor of two relative to that of the copper atom (62317 cm$^{-1}$); deuteration further decreased the ionization potential of the complex by 219 cm$^{-1}$ due to the shift of the zero point vibration energies. Furthermore, the ZEKE spectra revealed the copper-ammonia vibrations and ammonia torsion. For example, in Cu(NH$_3$)$_2$ the metal ion -ligand symmetric stretching and bending frequencies were measured to be 436 and 139 cm$^{-1}$, whereas the NH$_3$ torsion was determined as 32 cm$^{-1}$.