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NOVEL BONDING SITUATIONS IN NOBLE-GAS CHEMISTRY

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We are currently in a much better position to understand the factors underlying noble-gas compound formation. This has recently been accomplished by synthesizing over two dozen new xenon and krypton compounds in which the noble gas is bonded to organic fragments through nitrogen. The ligand groups consist of perfluoropyridines, nitriles and s-trifluorotriazine adducted to the Lewis acid cations XeF^+ and KrF^+.

The chemistry represents the first time the strongly oxidizing XeF^+ and KrF^+ cations have been bonded to organic moieties. The formation of $HC{\equiv}N{-}XeF^+AsF_6^-$ and several organic nitrile cation $RC{\equiv}NXeF^+$) led to successful attempts to bond one of the best fuels known, HC≡N, to what is one of the strongest oxidants known, KrF^+. Although the $HC{\equiv}N{-}KrF^+AsF_6^-$ salt is a violent detonator in the solid state at ca. -60 °C, it has been fully characterized by multi-NMR (^1H, ^{13}C, ^{15}N and ^{19}F) and low-temperature Raman spectroscopy. Three further examples of krypton-nitrogen bonded species in which the KrF^+ cation is bonded to an organic base have also been prepared, i.e., $R_FC{=}N{-}KrF^+$ (R_F = CF_3, C_2F_5, n-C_3F_7).

More recently, this chemistry has been extended to the $XeOTeF_5^+$ cation. Representative nitrile, perfluoropyridine and s-trifluorotriazine adduct cations have been prepared. The synthesis of a number of these adduct cations with $Sb(OTeF_5)_6^-$ as the counter ion offers the possibility of synthesizing thermally less stable $XeOTeF_5^+$ adduct cations at low temperature in low polarity solvents. This has become possible owing to the high solubility of the novel precursor salt, $XeOTeF_5^+Sb(OTeF_5)_6^-$.

Our recent discovery of the first krypton-nitrogen bonds and the previous existence of Kr-F bonded species have served to underscore the apparent anomalous non-existence of Kr-O bonds. We have recently put a considerable amount of effort into trying to synthesize the first such example of a Kr-O bond and will present the results of these findings.