ESR MASS-SELECTION MATRIX ISOLATION STUDIES OF THE DIATOMIC RARE GAS CATION RADICALS, $Kr_2{}^+$ AND $Xe_2{}^+$

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Electron spin resonance (ESR) spectra of the diatomic rare gas cation radicals $Kr_2{}^+$ and $Xe_2{}^+$ in their X $^2\Sigma$ ground electronic states were measured while trapped in solid neon matrices at 4K. Since the original mass spectrometric detection of diatomic rare gas cations in the 1930s, a number of investigative methods have been used to characterize them, including photoionization, electronic absorption, continuous emission, elastic-scattering, and photodissociation studies. Several theoretical studies have also been conducted in attempts to understand the electronic structure of these unusual ions. There have been no published reports of ESR studies of rare gas cations, whether molecular or atomic, isolated in rare gas matrices. The $Xe_2{}^+$ ESR spectrum was previously observed in a polycrystalline matrix of antimony pentafluoride. The magnetic parameters obtained in this earlier study show agreement within 20% of these neon matrix measurements. Apparently, there have been no previously published reports of ESR studies of $Kr_2{}^+$ under any experimental conditions. The magnetic parameters were extracted from the observed ESR spectra by an exact diagonalization of the spin Hamiltonian which also included quadrupole interaction. Mass-selection was employed to control the isotopic enrichment of the cations trapped in the solid neon matrices. Various isotopomers of the diatomic cations containing $^{83}Kr(I = 9/2)$, $^{131}Xe(I = 3/2)$, and $^{129}Xe(I = 1/2)$ were observed. Also, a preliminary ESR assignment for the mixed cation $Kr - Xe^+$ has been made.