MATRIX ISOLATION ESR STUDIES OF Hg RADICALS: Hg^+, HgD, HgH, and $Hg(CH_3)_2{}^+$

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Atomic mercury vapor was passed through various rare gas plasma discharges and condensed in neon, argon, and krypton rare gas matrices at cryogenic temperatures for electron spin resonance (ESR) investigations. The first ESR spectrum of Hg^+, observed in Ne, Ar, and Kr matrices is presented, with determination of its magnetic parameters, which exhibited excellent agreement with gas phase values. The ratio of the g_n ($g_n = \mu_I/I$) values for ^{199}Hg and ^{201}Hg is shown to vary slightly from Hg^+ to HgH/HgD. This variation can be attributed to electronic structure differences surrounding the mercury nucleus. Observation of Hg^+ in a Kr lattice also provides information on the required energy gap between the electron affinity of an isolated species and the ionization potential of the matrix host atom. HgH and HgD were observed in experiments where the plasma discharge was doped with a small percentage of H_2/D_2 gas. The HgH/HgD radicals were observed for the firs t time in a neon matrix, providing a comparison of the various magnetic parameters to earlier argon matrix results. The electronic structure and magnetic parameters of $Hg(CH_3)_2{}^+$ will be analyzed based upon these new matrix results for Hg^+ and HgH.