ELECTRON SPIN RESONANCE INVESTIGATION OF FORMATION MECHANISMS OF MATRIX ISOLATED H_4^+

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Hydrogen cluster ions are of interest as reactants in astrophysical processes and as simple models for theoretical calculations. In this work, the formation mechanism of H_4^+ and its deuterated isotopomers was investigated by varying the experimental conditions required to observe H_4^+ isolated in a neon matrix. The H_4^+ cluster was formed by mixing H_2, D_2, and HD gases with neon and depositing the mixtures onto a copper rod cooled by liquid helium. The resulting matrix was then x-irradiated at 60 keV for 30 minutes and electron spin resonance spectra were recorded. Previous studies conducted in our lab have indicated that hydrogen cluster cations can only be formed at extremely low temperatures (2.6 K) and are very sensitive to temperature change. In the current study, the local environment of the deposition region was characterized by investigating the allowable temperature range, the effect of sample gas flow rate, and the need for nearby cold surfaces.