INFRARED SPECTRUM OF N-OXIDOHYDROXYLAMINE [●ONH(OH)] PRODUCED IN REACTION H + HONO IN SOLID PARA-HYDROGEN

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Hydrogenation reactions in the N/O chemical network are important for an understanding of the mechanism of formation of organic molecules in dark interstellar clouds, but many reactions remain unknown. We present the results of the reaction H + HONO in solid para-hydrogen (p-H₂) at 3.3 K investigated with infrared spectra. Two methods that produced hydrogen atoms were the irradiation of HONO molecules in p-H₂ at 365 nm to produce OH radicals that reacted readily with nearby H₂ to produce mobile H atoms, and irradiation of Cl₂ molecules (co-deposited with HONO) in p-H₂ at 405 nm to produce Cl atoms that reacted readily with nearby H₂ to produce mobile H atoms. In both experiments, we assigned IR lines at 3549.6 (ν₁), 1465.0 (ν₃), 1372.2 (ν₄), 895.6/898.5 (ν₆), and 630.9 (ν₇) cm⁻¹ to N-oxidohydroxylamine [●ONH(OH)], the primary product of HONO hydrogenation. The assignments were derived according to the consideration of possible reactions and comparison of observed vibrational wavenumbers and their IR intensities with values predicted with the B3LYP/aug-cc-pVTZ method of quantum-chemical calculations. The agreement between observed and calculated D/H- and ¹⁵N/¹⁴N-isotopic ratios further supports these assignments. The role of this reaction in the N/O chemical network in dark interstellar clouds is discussed.