

Abstract Submitted
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Yield of electronically excited CN molecules from the dissociative recombination of HNC^+ ion with electrons¹ RAINER JOHNSEN, RICHARD ROSATI, University of Pittsburgh, DAPHNE PAPPAS, Army Research Lab, MICHAEL GOLDE, University of Pittsburgh — We report flowing-afterglow measurements of the CN(B-X) and CN(A-X) emissions from the dissociative recombination (DR) of HNC^+ ions. A separate drift-tube study showed that the reaction $\text{Ar}^+ + \text{HCN}$, the precursor reaction used in the flow-tube experiment, produces mainly HNC^+ rather than its HCN^+ isomer. Recombining HNC^+ afterglows showed emissions of CN (B-X) and CN(B-A) but some arise from excitation transfer of metastable argon, $\text{Ar}^* + \text{HCN}$. By adding xenon, Ar^* atoms were removed and the pure recombination spectrum was recovered. Models simulating the ion-chemical processes, diffusion and gas mixing, were fitted to observed position-dependent CN band intensities. Absolute yields of CN (B) and CN (A) were inferred by comparing band intensities to those of CO bands from DR of CO_2^+ ions. We conclude that the 300 K recombination coefficient of HNC^+ is close to $2 \times 10^{-7} \text{ cm}^3/\text{s}$, that CN(B) is formed with a yield of $\sim 20\%$ and CN(A) with a yield of $\sim 12\%$. The rotational temperature of CN(B) is around 2500 K, and CN(B) and CN(A) are far more vibrationally excited than predicted by the “impulse model” of Bates. This finding suggests that the recombination may involve a multistep mechanism.

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