# Measurement of rate constants for reactions of $C_3N$ with small molecules using the CRESU technique

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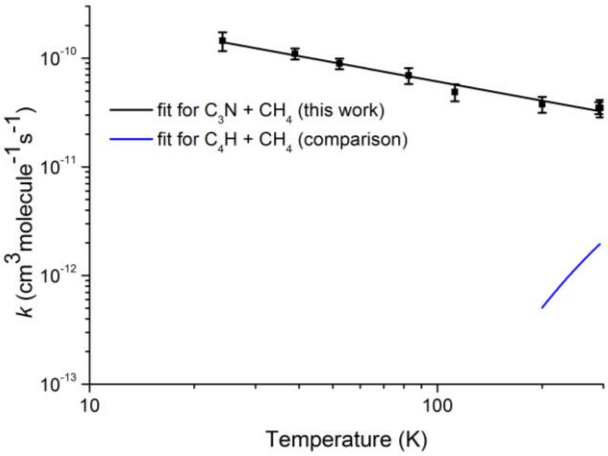


Since the first detection of radical species in the interstellar medium, attention has grown on polyynes, cyanopolyynes and corresponding radicals. This family encompasses a large number of species, from the very basic HCN to the largest linear compound to date, $HC_{11}N$. The key to the growth of larger members is the reactivity of intermediate sized ones, such as $C_3N$ detected in multiple environments[1]. Astrochemical models were established for molecular clouds, planet atmospheres and circumstellar envelopes to explain the formation of these species.

Encouraged by previous work on $C_4H$[2] rate constant measurements over a large range of temperature and by using the CRESU (Cinétique de Réaction en Ecoulement Supersonique Uniforme) method we have measured the rate constants over the [24-300] K range for reactions of $C_3N$ with $C_nH_x$ compounds ($n$=1…3), CO, $H_2$, $O_2$ and $NH_3$. These results are the very first experimental data on $C_3N$ reaction rates. Unlike expected from theoretical models and analogy with the isoelectronic species $C_4H$, the C3N proved extremely reactive at low temperature for almost all of these species, and quite reactive even at low temperature with $H_2$. The resulting measurements should be of significant interest for astrochemical models that essentially rely on similarity between compounds and extrapolation to fill the gap of insufficient experiment data.

Experimental data was acquired using pulsed laser photolysis on a synthesized precursor, $BrC_3N$, generating the radical in-flow and laser-induced fluorescence detection. LIF detection was based on experimental data acquired by Hoshina and Endo[3].

**References**

[1] Bell, M. B.; Feldman, P. A.; Travers, M. J.; McCarthy, M. C.; Gottlieb, C. A.; Thaddeus, P., Astrophysical Journal Letters, L61, 483 (1997)
[2] Berteloite, C.; Le Picard, S. D.; Birza, P.; Gazeau, M.-C.; Canosa, A.; Bénilan, Y.; Sims, I. R., Icarus, 2, 194 (2008)
[3] Hoshina, K.; Endo, Y., J. Chem. Phys., 18, 127 (2007)