

## QUANTITATIVE MEASUREMENT OF NCN FOR THE UNDERSTANDING OF PROMPT-NO FORMATION

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Since the early 1970's work by Fenimore [1], prompt-NO formation has been well understood to be initiated by the reaction:  $\text{CH} + \text{N}_2 = \text{HCN} + \text{N}$ . For 30 years, a reasonable agreement has been obtained between NO concentrations measured in flames and computed by simulation codes. Very recently, it has been demonstrated that the reaction  $\text{CH} + \text{N}_2 = \text{HCN} + \text{N}$ , known to be spin-forbidden since it had been postulated, has to be replaced by the reaction  $\text{CH} + \text{N}_2 = \text{NCN} + \text{H}$  [2]. El Bakali et al. [3] introduced the new key reaction in a detailed mechanism and concluded that the rate constant determined by Moskaleva and Lin [2] was too low to yield a good agreement between the experimental NO profile and the simulated one. Few studies have been carried out the NCN measurement in laminar low-pressure flames [4, 5].

Combining the Cavity Ring Down Spectroscopy (CRDS), and the Laser Induced Fluorescence (LIF), we have been able to quantitatively measure the NCN radical profile in laminar low-pressure flames stabilised at 40 torr. Thanks to PGOPHER [6], the experimental spectrum of NCN at 1800K was simulated and the absorption cross section was determined. First, in a rich ( $\phi=1.25$ )  $\text{CH}_4/\text{O}_2/\text{N}_2$  flame where the peak value was determined to be  $6.2 \cdot 10^{-14} \text{ mol} \cdot \text{cm}^{-3}$  with an uncertainty of 50% due to the limit of sensitivity of the CRD technique and the very low concentration of NCN in this flame. Second, in a rich ( $\phi=1.25$ )  $\text{C}_2\text{H}_2/\text{O}_2/\text{N}_2$  flame where the peak of the NCN concentration was measured to be  $1.3 \cdot 10^{-13} \text{ mol} \cdot \text{cm}^{-3}$  with an accuracy better than 20%. LIF profiles of NCN have been measured relatively in both flames yielding the same relative coefficient.

From the temperature profiles determined with a coated thermocouple, and using Chemkin/Premix II and GDFkin<sup>®</sup>3.0\_NCN mechanism [3], the NCN concentration was simulated to be one order of magnitude lower in the  $\text{CH}_4/\text{O}_2/\text{N}_2$  flame than the one measured experimentally. The reaction rate constants for the NCN radical are widely estimated and have to be evaluated more precisely since the radical is now unwaveringly involved in the prompt-NO formation.

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### References:

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