

# **A Three-Channel Thermal Dissociation Cavity Ring-Down Spectrometer for Simultaneous Measurement of Ambient Total Peroxy Nitrates, Total Alkyl Nitrates, and NO<sub>2</sub>**

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## **Abstract**

A newly constructed thermal dissociation cavity ring-down spectrometer (TD-CRDS) for the simultaneous measurement of ambient total peroxy nitrates ( $\Sigma$ PNs, RO<sub>2</sub>NO<sub>2</sub>), total alkyl nitrates ( $\Sigma$ ANs, RONO<sub>2</sub>), and NO<sub>2</sub> was presented.  $\Sigma$ PNs and  $\Sigma$ ANs were detected as NO<sub>2</sub> with the CRDS instrument after thermal dissociation. PNs and ANs completely dissociated at 180°C and 360°C, with conversion efficiencies of 96% and 99%, respectively. The effects of NO<sub>2</sub> and NO on measurement in different temperatures and two types of thermal dissociation inlet (TDI) were further explored. The influence of ambient NO<sub>2</sub> and NO on PNs and ANs in the improved TDI (TDI-2) was significantly improved. Possible interferences, mainly O<sub>3</sub> were also quantitatively characterised. A calibration method for measuring  $\Sigma$ PNs and  $\Sigma$ ANs was established. To further enhance the measurement accuracy, the consistency of the observed NO<sub>2</sub> in the three channels was tested, which achieved good agreement. The detection limits of the TD-CRDS instrument for NO<sub>2</sub>,  $\Sigma$ PNs, and  $\Sigma$ ANs were determined as 6.5, 6.8, and 8.6 pptv (10 s, 1 $\sigma$ ), respectively. Observations of PNs and ANs were conducted in a suburban site in Hefei, China, from September 2–30, 2021, using the TD-CRDS instrument, and the consecutive time series of PNs and ANs were derived, verifying the capability of the TD-CRDS instrument for continuous field observations of  $\Sigma$ PNs and  $\Sigma$ ANs.

## **Early Career Scientist**

NO, I am not an early career scientist.

## **IGAC Activities**

Allin-Wayra: Small Sensors for Atmospheric Science, MAP-AQ: Monitoring, Analysis and Prediction of Air Quality

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