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**Application of chemical ionization mass spectrometry in the new particle formation studies.<sup>1</sup>**

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Chemical ionization mass spectrometry (CIMS) has been demonstrated to be a highly sensitive and fast-response analytical technique. Unlike the traditional, highly-energetic electron impact mass spectrometry (EI-MS), CIMS utilizes soft-ionization methods and thus can generate mass spectra with less fragmentation, which can facilitate the interpretation of molecular information of the analytes. In addition, the ion chemistry implemented by CIMS can be highly versatile, which can be designed specifically for a certain analyte. These advantages of CIMS make it suitable for new particle formation (NPF) studies. For instance, CIMS is the only available technique for in-situ measurements of H<sub>2</sub>SO<sub>4</sub> and amines, which are the key NPF precursors and their ambient concentrations are usually on the order of  $\sim 10^6$  molecules cm<sup>-3</sup> or much less. In this work, the ion chemistry and ion sources utilized by CIMS during NPF studies are introduced, including the measurement principles and calibration procedures. Field NPF study results using CIMS at various environments are demonstrated.

<sup>1</sup>Application of chemical ionization mass spectrometry in the new particle formation studies