

## **Simultaneous X-ray and Ion Beam Techniques for the Characterisation and Fingerprinting of Fine Particle Air Pollution and its Sources in the Asian Region**

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High energy heavy ions, like MeV protons, have been used for many years to induce X-rays, gamma rays and nuclear reaction products to characterise a broad range of samples. In the main these techniques can non-destructively analyse nanogram samples with ( $\mu\text{g/g}$ ) sensitivity in a few minutes of running time. This paper will discuss the simultaneous application of four accelerator based ion beam analysis (IBA) techniques to the characterisation and quantification of fine particle air pollution studies in Asia.

The four techniques used were, Proton induced X-ray Emission (PIXE), Proton Induced Gamma ray Emission (PIGE), Particle Elastic Scattering analysis (PESA) and Rutherford Backscattering (RBS). These methods are elemental analysis methods, PIXE was used for elements from Al to Pb, PIGE for F and Na, PESA for total H analysis and RBS for C, N and O determinations. These four techniques, all using MeV protons, are capable of simultaneously providing information on up to 35 different elements from H to Pb in the periodic table.

At the Australian Nuclear Science and Technology Organisation (ANSTO) we have been collecting fine particle filter papers from sampling units around Australia and throughout the Asian region for many years. Some sampling sites have been running every Wednesday and Sunday continuously for more than 10 years now. Data will be provided on the composition and characterisation of this key fine particle air pollution, methods for fingerprinting sources and for quantifying source contributions to the total mass. Recent novel methods of Positive Matrix Factorisation (PMF) for source apportionment and Potential Source Contribution Functions (PSCF) for identifying source fetch regions using wind back trajectory information will be discussed. In particular examples of large dust movements from the Gobi desert regions in China and Mongolia and their impacts on Korea, Japan and possible industrial emissions from mainland China into places like Manila in the Philippines will be discussed.