ESRF	**Experiment title:** X-Ray Absorption by Flame Generated Nanoparticles	**Experiment number**: SC-976
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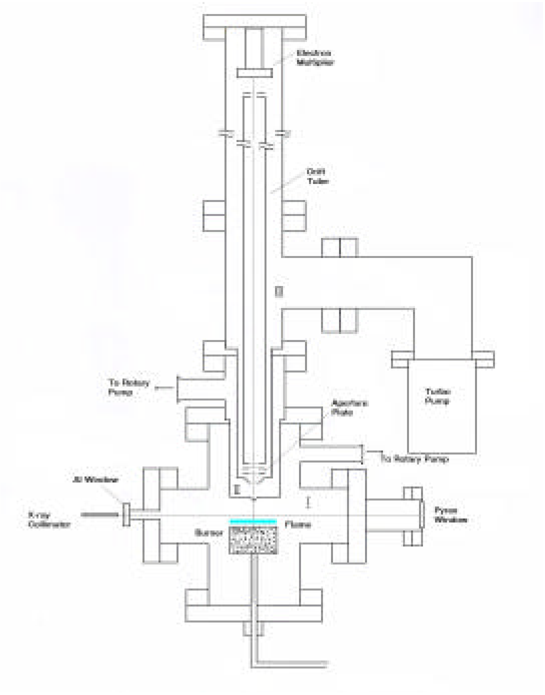
Report: In a previous experiment [1-3], the absorption of high energy x-rays by soot nanoparticles generated in an ethylene diffusion flame burning in air was demonstrated by measuring the ionisation thus produced using an atmospheric pressure Langmuir Probe. The large amount of ionisation arising from x-ray absorption can be explained using a model based upon multiple scattering of the ejected Auger electron that produces secondary electron emission, particle charging and tertiary electron emission due to the high electric fields thus generated in the agregated nanostructure of the soot particle [4]. Such models have been developed by astrophysicists to model the influence of cosmic x-rays on interstellar dust grains [5,6]. The outcome of this electron emission process is expected to be the fragmentation of the soot particle and in order to study this in more detail, a mass spectrometric study of the reaction is planned. As a first step towards this measurement, a new apparatus has been constructed in which a premixed ethylene diffusion flame is burned under vacuum (20 Torr) and ions coming from the flame due to natural ionisation and to x-ray absorption pass through two stages of differential pumping into a chamber held at 10^{-5} Torr where the mass spectrometer will be located. This apparatus is illustrated in figure 1. X-rays enter the flame chamber via an aluminium window that employs commercial grade aluminium foil (10 micron thickness), held in place using a Ultra-Torr © fitting [7] (Fig. 2). A first test of this system was performed during the current experimental run described here [8]. It was found that indeed, a measurable ionisation signal could be detected on the entrance aperture to the mass spectrometer assembly when the x-ray beam illuminated the flame and that this signal was much larger than that due to background absorption and natural flame ionisation. For air rich flames (turquoise in colour under vacuum conditions), the signal increased with height above the burner achieving an essentially steady value. For a fuel rich flame (yellow-orange in colour due to light emission from soot particles), the signal was found to decrease with height above burner. (Fig. 3). This is an indication that the particles that are undergoing this collective ionisation process are in fact very small soot particles (few nm diameter) and not the larger particles responsable for visible light emission. This finding has been verified by combined small angle x-ray scattering/ionisation studies performed at the APS in the US [9]. {Work supported by the European Office of Aerospace Research and Development, Air Force Office of Scientific Research, Air Force Laboratory under Contract No. F61775-01-WE060, ESRF and by the French Programme Nationale du Physico-Chimie du Milieu Interstellaire.}



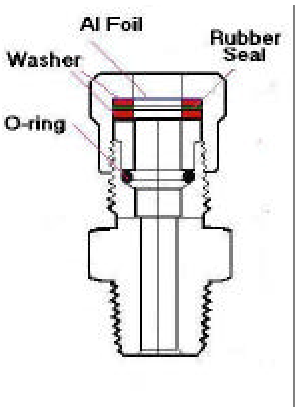


Figure 1. Vacuum burner apparatus.

Fig. 2. Aluminium window assembly.

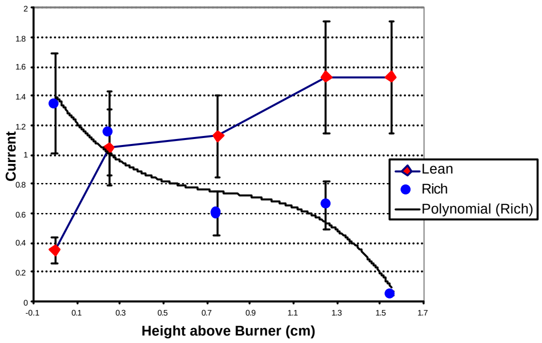


Fig. 3. . Ionization current (arbitrary units) due to x-ray absorption, measured on entrance electrode to mass spectrometer as a function of height above burner. The lines serve rather to guide the eye.

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