NASA TECH BRIEF

NASA Pasadena Office

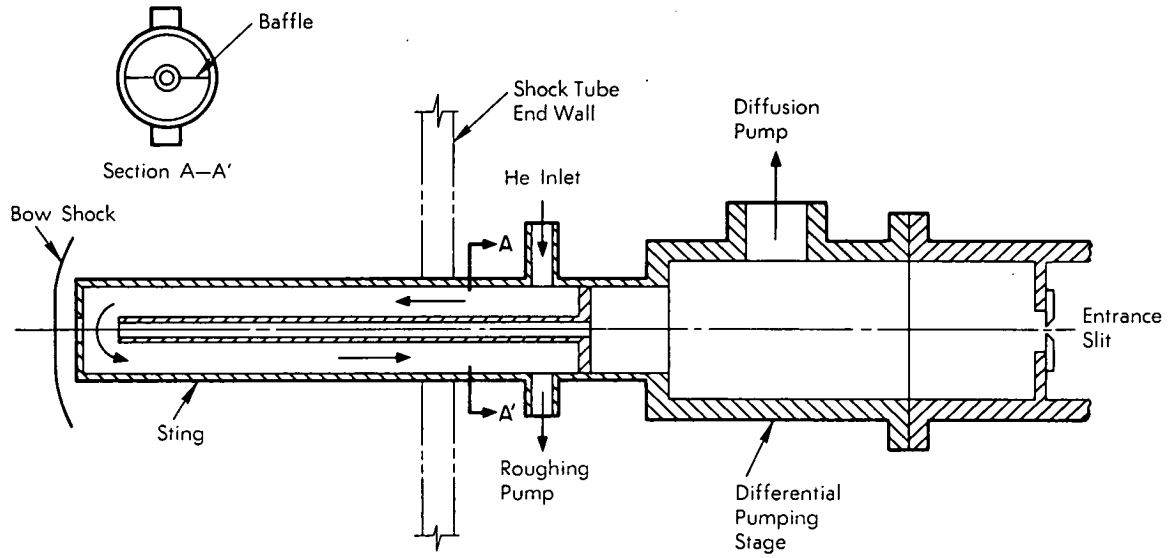
Helium Window for Shock-Tube Monochromators

The problem:

To couple a vacuum ultraviolet monochromator to a shock tube so that quantitative measurements of the radiating gases in plasmas can be made without the loss of high energy ultraviolet light because of absorption by the salt windows ordinarily used in the entrance slit of a monochromator.

How it's done:

A schematic representation of the coupling system is shown in the diagram. The shock tube probe, or sting, is a cylinder (3.175-cm diam) with a flat-faced end which faces the shock wave; a small hole (2-mm diam) permits passage of the radiation emitted in the shock layer. A second hollow cylinder of smaller diameter is located inside the sting; the annular space between the cylinders is divided into two channel-like parts by the baffle shown in section A-A′. Helium gas is admitted into one end of the channel, and a roughing pump is used to maintain a flow of helium in the baffle system; in operation, helium gas flows by the



The solution:

A helium gas window formed by differential pumping through a small aperture in the monochromator's entrance pupil. Helium gas is transparent to the high energy ultraviolet light which is readily absorbed by inorganic salt windows.

(continued overleaf)

small window hole in the flat-faced end of the assembly because the pressure at the window of the sting is adjusted to balance the initial pressure in the shock tube. A second stage of differential pumping in an antechamber reduces the pressure to a few tenths of a newton (few microns) at the slit of the spectrograph. Pressures of about 0.01 newton (10^{-4} mm) are maintained inside the body of the monochromator when helium is flowing. In this manner, absorbing gases are removed from the optical path leading from the sting orifice to the monochromator. The bow shock which forms over the nose of the sting creates a slab of gas about 1 cm thick. The gas pressure in the bow shock region varies from 100 to 300 kN/m^2 (1 to 3 atm) and the hot gas undergoes free expansion through the orifice into the sting cavity.

Note:

Requests for further information may be directed to:

Technology Utilization Officer
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Reference: TSP 72-10556

Patent status:

NASA has decided not to apply for a patent.

Source: George M. Thomas of
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under contract to
NASA Pasadena Office
(NPO-11852)