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NASA TECH BRIEF

Solar X-Ray Spectrum Reproduced in Vacuum

The problem:

Commercially available X-ray sources that have been investigated show a major deviation from the solar X-ray spectrum both in energy and intensity. Operation of these sources outside a vacuum chamber to beam the X-rays through a suitable window results in absorption of the desired low energy rays and transmission of the undesired high energy rays. Additionally, these sources require extensive shielding to provide operator safety.

The solution:

Two techniques have been explored that afford the production of the desired low energy X-rays at a relatively low investment cost by modifying commercially available ion tubes and combining them with standard power supplies and control circuitry.

How it's done:

In the earlier application, the cathode assembly consists of a VG1-A ionization tube from which the grid structure has been removed and whose inside is coated with a conducting silver film to carry the necessary acceleration voltage. The filament is heated with a Variac, whose grid lead is connected to the anode of a tungsten target. In this way, the feedback circuit of the Variac is used to stabilize emission current to levels as low as 10 μa. Wavelengths correspond to accelerating voltages of 0.12 kv to 6.0 kv while the power supply delivers 0 to 5.0 kv. This produces a shortest available wavelength of 2.38 Å and a dominant wavelength of approximately 3.77 Å due to the energy distribution of the X-rays produced.

In a later application, the grid of a Veeco type RG-758 ion gage is replaced with a tantalum target while the balance of the system repeats that of the former except for a 10-micron-thick aluminum foil window interposed between the gage and the detector, in this case X-ray film of known response characteristics. The predominant wavelength of X-rays transmitted by the foil window is found to be 9 Å.

This latter arrangement affords an advantage over the earlier system in that closer spacing between filament and target may be had. This reduces space charge effects and permits larger target currents that result in increased X-ray flux production.

Note:

Inquiries concerning this innovation may be directed to:

Technology Utilization Officer
Manned Spacecraft Center
Houston, Texas 77058
Reference: B67-10164

Patent status:

No patent action is contemplated by NASA.

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