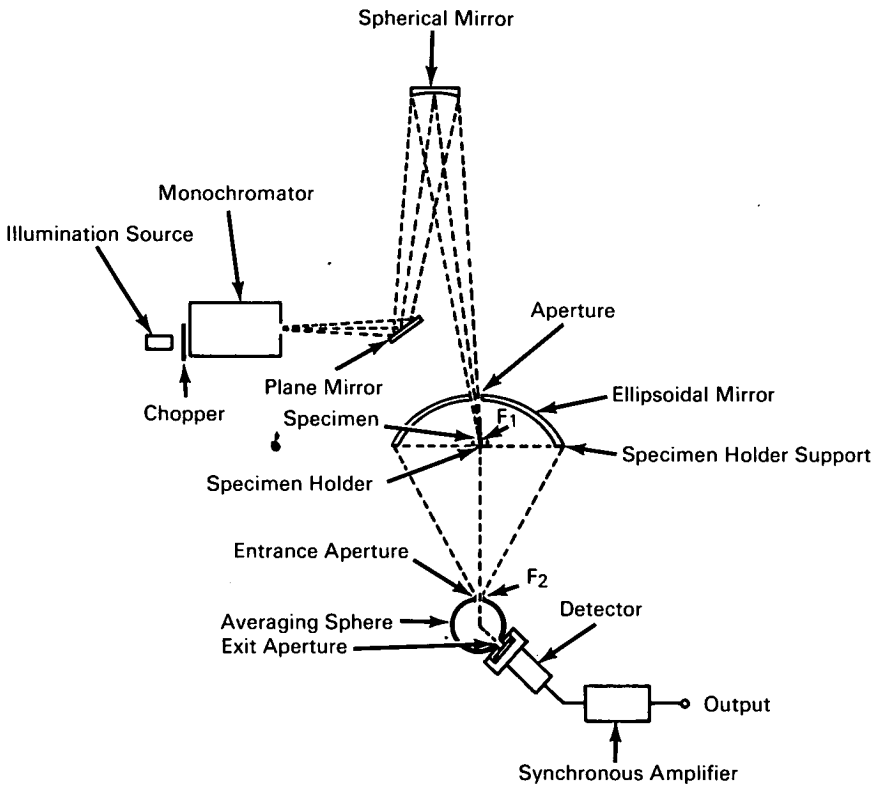
NASA TECH BRIEF

Ellipsoidal-Mirror Reflectometer Accurately Measures Infrared Reflectance of Materials



The problem:

To develop a reflectometer that will accurately measure the reflectance of specimens in the range of 20° to 1000° K at wavelengths in the infrared beyond 2.5 microns and under geometric conditions approximating normal irradiation and hemispherical viewing. Conventional instruments (including integrating sphere reflectometers, Coblentz hemisphere reflectometers, heated-cavity reflectometers, and paraboloidal-mirror reflectometers) generally do not afford the required high accuracy or versatility with regard to directional measurement of specular and diffuse reflectance.

The solution:

A reflectometer that includes an ellipsoidal mirror, which eliminates aberrations such as in spherical mirrors; a specially coated averaging sphere associated with a detector for minimizing spatial and angular sensitivity; and an incident flux chopper. The specimen and detector are separated by approximately

(continued overleaf)

17 inches to provide ample space for cooling or heating the specimen without affecting the detector. By chopping the incident flux from an illumination source and using a synchronous amplifier to amplify the detector signal, the effect of flux emitted by a hot specimen is eliminated.

How it's done:

The flux from the illumination source is chopped (typically at a 11.3 cps rate) before entering a conventional monochromator. The monochromatic beam is then refocused by the plane and spherical mirrors through an aperture to the specimen supported at the focal point F_1 of the ellipsoidal mirror. The specimen holder is supported from crossed thin strands secured to the periphery of the ellipsoidal mirror. The reflected flux from the specimen is focused to the entrance aperture of an averaging sphere at the conjugate focus F_2 of the ellipsoidal mirror. The interior surface of the averaging sphere is coated with mu sulfur or an opaque film of vapor-deposited gold to increase the radiation-collection efficiency as well as to minimize the spatial and angular sensitivity of the system. This sphere includes an exit aperture which is at an angle of 135 degrees to the entrance aperture. The sensitive elements of the detector (thermopile or bolometer elements), positioned adjacent to the exit aperture of the averaging sphere, are connected to the synchronous amplifier.

Notes:

1. The detection efficiency of the system can be increased by the use of appropriate shields.
2. Inquiries concerning this invention may be directed to:

   Technology Utilization Officer
   Goddard Space Flight Center
   Greenbelt, Maryland 20771
   Reference: B67-10444

Patent status:

This invention is owned by NASA, and a patent application has been filed. Rotalty-free, nonexclusive licenses for its commercial use will be granted by NASA. Inquiries concerning license rights should be made to NASA, Code GP, Washington, D.C. 20546.

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