tion, one would adapt the parameters to
the reflector at hand and seek to keep the
phase deviation below some maximum al-
lowable value across the range of angles of
incidence for the field of view of the instru-
ment of which the reflector is a part. To ob-
tain compensation over a spectral band, it
would be desirable to perform a wider opti-
mization involving the bandwidth of the
light and the dispersion characteristics of
each dielectric layer.

The lower part of Figure 2 illustrates
an example of compensation for the
anisotropy of Figure 1 for monochro-
matic light. In this case a combination of
\( n_o = 1.5, \quad n_e = 1.45, \quad d_1 = d_2 = d/2, \) and an
overall thickness of 0.5676 wavelengths
was chosen to satisfy a requirement to
keep the maximum phase anisotropy
below 0.0075° at angles of incidence as
large as 13°.

This work was done by John Hong of Cal-
tech for NASA’s Jet Propulsion Labora-
tory. Further information is contained in a
TSP (see page 1).
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Optical Characterization of Molecular Contaminant Films
A theoretical model is correlated with measured spectral transmittances and VUV exposures of
spacecraft optics.

Lyndon B. Johnson Space Center, Houston, Texas

A semi-empirical method of optical
characterization of thin contaminant
films on surfaces of optical components
has been conceived. The method was
originally intended for application to
films that become photochemically de-
posited on such optical components as
science windows, lenses, prisms, thin-
film radiators, and glass solar-cell covers
aboard spacecraft and satellites in orbit.
The method should also be applicable,
with suitable modifications, to thin optical
films (whether deposited deliber-
ately or formed as contaminants) on op-
tical components used on Earth in the
computer microchip laser communica-
tions and thin-film industries.

The method is expected to satisfy the
need for a means of understanding and
predicting the reductions in spectral
transmittance caused by contaminant
films and the consequent deterioration
of performances of sensitive optical sys-
tems. After further development, this
method could become part of the basis
of a method of designing optical systems
to minimize or compensate for the dele-
terious effects of contaminant films. In
the original outer-space application,
these deleterious effects are especially
pronounced because after photochemi-
cal deposition, the films become dark-
ened by further exposure to solar vac-
uum ultraviolet (VUV) radiation.

In this method, thin contaminant
films are theoretically modeled as thin
optical films, characterized by known or
assumed values of thickness, index of re-
fraction, and absorption coefficient, that
form on the outer surfaces of the origi-
nal antireflection coating on affected op-
tical components. The assumed values
are adjusted as needed to make actual
spectral transmittance values approxi-
mate observed ones as closely as possible
and to correlate these values with
amounts of VUV radiation to which the
optical components have been exposed.

In an initial study, the method was ap-
plied in correlating measured changes in
transmittance of high-purity fused sil-
ica photochemically coated with silicone
films of various measured thicknesses
and exposed to various measured
amounts of VUV radiation. In each case,
it was found to be possible to select an
index of refraction and absorption coeffi-
cient that made the ultraviolet, visible,
and infrared transmission changes pre-
dicted by the model match the correspond-
ing measured transmission changes al-
most exactly.

This work was done by James T. Visentine of
The Boeing Co. for Johnson Space Center.

This invention is owned by NASA, and a
patent application has been filed. Inquiries
concerning nonexclusive or exclusive license
for its commercial development should be ad-
dressed to the Patent Counsel, Johnson Space
Center, (281) 483-0837. Refer to MSC-
23931.