

ON THE ASTROMINERALOGY OF THE 13 MICRON FEATURE IN THE SPECTRA OF OXYGEN-RICH AGB STARS

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ABSTRACT

Approximately half the oxygen-rich AGB stars to be investigated spectroscopically exhibit a feature at 13 μm . The carrier of this feature has not yet been unequivocally identified, but has been attributed to various dust species, including corundum ($\alpha\text{-Al}_2\text{O}_3$), spinel (MgAl_2O_4) and silica (SiO_2). We have used the 1-d radiative transfer code DUSTY to model the effects of composition and optical depth on the shape and strength of the emerging 13 μm feature from corundum, spinel and quartz grains. These models demonstrate that i) spinel is unlikely to be the carrier of the 13 μm feature; ii) if corundum is present in these circumstellar dust shells, even at very low relative abundances, a 13 μm feature should be observed; iii) corundum's weak ~ 21 μm feature will not be observed, even if it is responsible for the ~ 13 μm feature; iv) corundum grains must be spherical to exhibit the 13 μm feature. Other grain shapes (spheroids, ellipsoids, hollow spheres) shift the features to longer wavelengths for both spinel and corundum; and v) if silica grains are the carrier of the 13 μm feature they are unlikely to be either spherical or the polymorph quartz.

More laboratory optical data for the polymorphs of silica are needed to determine whether they are the carrier of the ~ 13 μm feature.

