INFRARED DIFFUSE REFLECTANCE SPECTRA OF BINARY MIXTURES OF OLIVINE, ENSTATITE AND PLAGIOCLASE; K. Sato and M. Miyamoto, Mineralogical Institute, Graduate School of Science, University of Tokyo, Hongo, Tokyo 113, JAPAN

We measured infrared diffuse reflectance spectra of binary mineral mixtures of olivine, enstatite and plagioclase and interpreted the spectra in the wavenumber range from 1500 to 800 cm^{-1} to detect the presence of each mineral in the mixtures. The absorption band at 845 cm^{-1} in the spectra of the mixtures shows the presence of olivine, the band at 900 cm^{-1} shows enstatite, and the band at 1438 cm^{-1} shows plagioclase.

Reflectance spectra provide a technique for probing chemical and mineralogical compositions of planetary materials, because their compositions affect the positions and strengths of absorption bands. The purpose of this investigation is to study the relationship between mineral compositions of mixtures and the wavenumber positions of absorption bands in their diffuse reflectance spectra in the mid-infrared wavelength region.

The samples examined in this study were fabricated from three kinds of minerals: olivine (San Calros), enstatite (Bamble) and plagioclase (Bad Vermilion Lake). After crushing these minerals into powder, we sized by using a 100 μm-size sieve and made binary mineral mixtures (10, 30, 50 wt.%). Details of reflectance measurements are described in [1].

In this study, we direct our attention to the range of 1500-800 cm^{-1} because the atmosphere has high transparency in this range. The prominent absorptions are due to Si-O stretching vibrations of silicates within the samples in this wavelength range [e.g., 2]. Figs. 1-6 show the reflectance spectra of the three minerals and their mixtures. Table 1 summarizes the wavenumber positions of major absorption bands of the minerals.

Olivine: The absorption band at 845 cm^{-1} is due to the presence of olivine and this absorption band is not disturbed by the presence of enstatite or plagioclase (Figs. 1, 4 and 5). Therefore, the absorption band at 845 cm^{-1} enables us to detect the presence of olivine in the mixtures. We can recognize this band in the spectra of mixtures with more than 10% mass fractions of olivine. Mineral mixtures with large mass fractions of olivine display a strong absorption band at 1123 cm^{-1}. The 1008 cm^{-1} band in the spectrum of olivine apparently shifts toward 1023 cm^{-1} in the reflectance spectra of olivine-enstatite mixtures because enstatite has an absorption band at 1023 cm^{-1}. The 1008 cm^{-1} band also shifts toward 1033 cm^{-1} in the reflectance spectra of olivine-plagioclase mixtures because of the 1033 cm^{-1} band of plagioclase.

Enstatite: The reflectance spectrum of enstatite has an absorption band at 900 cm^{-1} which is free from disturbances due to olivine or plagioclase (Fig. 2). We can recognize this band in the spectra of mixtures with more than 30% mass fraction of enstatite (Figs. 4 and 6). The 1023 cm^{-1} band apparently shifts toward 1008 cm^{-1} in the reflectance spectra of enstatite-olivine mixtures with increasing olivine and oppositely shifts toward 1033 cm^{-1} in the spectra of enstatite-plagioclase mixtures with increasing plagioclase. The 1185 cm^{-1} band of enstatite cannot be distinguished from the 1192 cm^{-1} absorption band of plagioclase in the reflectance spectra of enstatite-plagioclase mixtures.

Plagioclase: The absorption band at 1438 cm^{-1} exhibits the presence of plagioclase in mineral mixtures (Figs. 3, 5 and 6) because neither olivine nor plagioclase has absorption bands around this wavenumber position. This band can be detected in the spectra of mixtures with more than 30% mass fractions of plagioclase. We can recognize the 1192 cm^{-1} absorption band in the spectra of the plagioclase-olivine mixtures with more than 30% mass fractions of plagioclase (Fig. 5). The 1033 cm^{-1} band apparently shifts toward 1023 cm^{-1} in the reflectance spectra of plagioclase-enstatite mixtures with increasing enstatite and shifts toward 1008 cm^{-1} in those of plagioclase-olivine mixtures with increasing olivine.

REFERENCES: [1] Miyamoto, M. (1994) Meteoritics, 29, 849-853 [2] Sanford, S. A. (1993) Meteoritics, 28, 579-585.

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Table 1. Summary of the wavenumber positions of major absorption bands.

Sample	Wavenumber positions (cm^{-1})		
olivine	1123,	1008,	842
enstatite	1185,	1023,	900
plagioclase	1438,	1192,	1033

Fig. 1

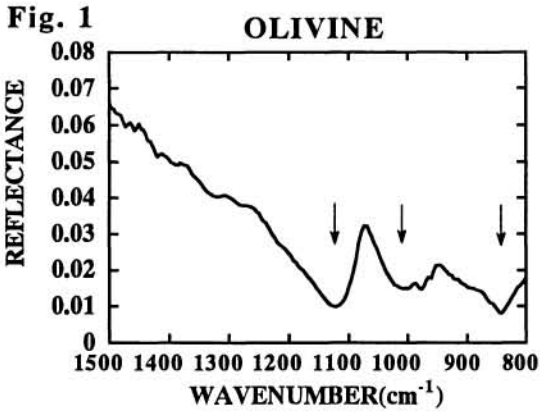

Fig. 2

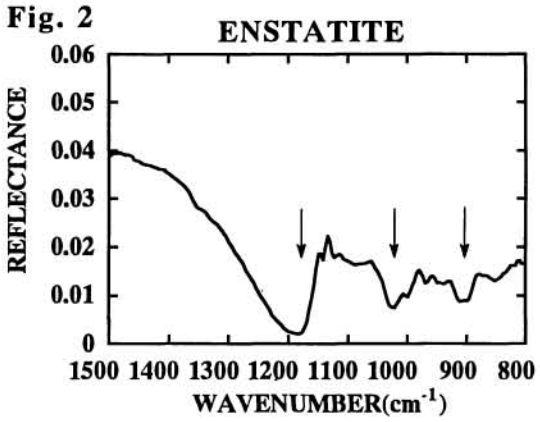

Fig. 3

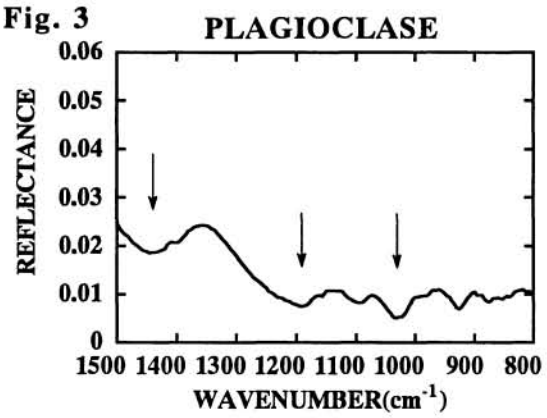

Fig. 4

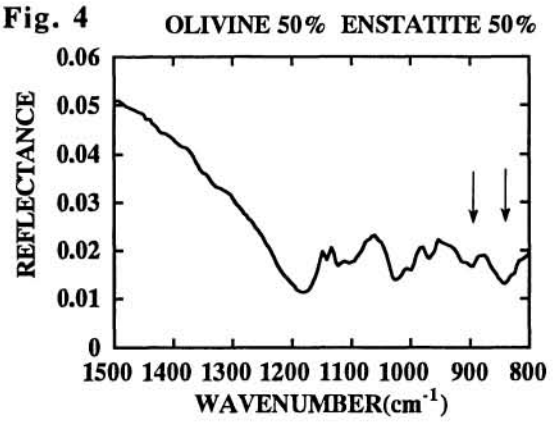

Fig. 5

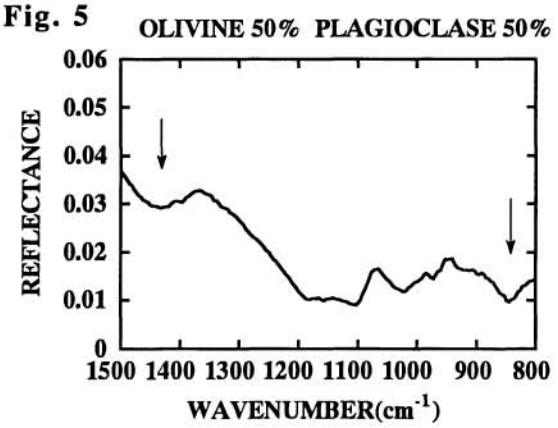

Fig. 6