Reflectance spectroscopy (0.35-2.5 μm) of low calcium pyroxene + metal mixtures

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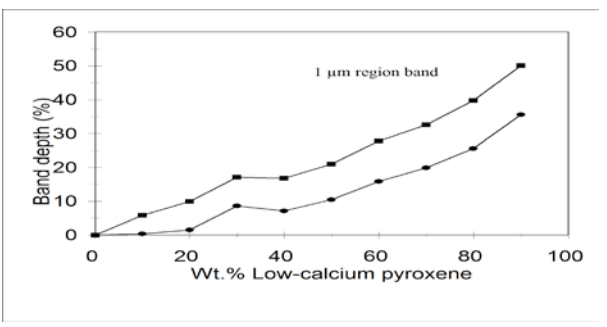
Low-calcium pyroxene (LCP) and Fe-Ni metal are major components of a number of meteorite classes. There is also spectroscopic evidence for orthopyroxene ± metal being the major spectrally active components on a number of asteroids. To improve our ability to determine the composition of such assemblages (pyroxene composition, pyroxene:metal abundance, presence of accessory phases), we undertook a systematic spectral reflectance study (0.35-2.5 μm) of powdered mixtures of LCP+meteoritic metal produced at 10 wt.% intervals of the end members.

LCP reflectance spectra are characterized by two Fe^{2+} absorption bands near 1 and 2 μm, while meteoritic metal is characterized by a featureless, overall red spectral slope.

For the mixtures, increasing amounts of metal cause a number of systematic spectral changes, including: (1) general decrease in reflectance; (2) decrease in the depths of the 1 and 2 μm region pyroxene absorption bands; (3) movement of both LCP absorption band minima to longer wavelengths; and (4) progressive reddening of overall spectral slopes.

The 2 μm band is weaker than the 1 μm band and also shows a more rapid decrease in band depth, becming largely indistinguishable <3% deep) at >80 wt.% metal content, while the 1 μm band has a band depth >5% at 90 wt.% metal (Figure 1).



It was found that removal of straight line continua over the 1 and 2 μm absorption bands was sufficient to recover band centers, required for determining LCP composition.