

MÖSSBAUER AND ELECTRONIC ABSORPTION STUDIES OF MIXED VALENCE IRON SILICATES AND PHOSPHATES

AMTHAUER, Georg; ROSSMAN, George R.; Division of Geological and Planetary Sciences, California Institute of Technology, Pasadena, CA 91125

Mössbauer and electronic absorption spectra were taken from a series of silicates (ilvaite, deerite, babingtonite, julgoldite, aegirine, etc.) and phosphates (vivianite, rockbridgeite, lazulite, etc.) in order to study cooperative phenomena between Fe ions (e.g. thermally delocalized electrons, optically excited electron exchange). In contrast to earlier studies several of these minerals contain Fe^{2+} and Fe^{3+} as an essential constituent of the structure. The following conclusions result:

1. The ^{57}Fe Mössbauer spectra of some of these minerals (deerite, julgoldite, ilvaite) reveal absorption patterns which arise from thermally delocalized electrons of iron ions in crystallographic equivalent sites.
2. At room temperature only a small portion of the iron ions take part in the electron delocalization process indicating that the "site equivalence" is partly removed by impurities and lattice defects which may depend on the conditions of formation of the mineral.
3. The amount of delocalization is also dependent on the polymerisation and the kind of polyhedral sharing.
4. In most of the electronic absorption spectra (vivianite, rockbridgeite, ilvaite) multiple absorption bands are associated with the intervalence interaction (e.g. vivianite, 860 nm and 640 nm).