Application Note

170-NF-0207

Analysis of mineral distribution in a rock slice by Near Field IR Spectroscopy (II)

Introduction

The metamorphic rock with high refractive index is suitable for Near Field IR measurement when its surface is polished. The composition of minerals contained in metamorphic rock depends on the different denaturation process caused by heat and pressure and surrounding earth crust when the rock was formed. In the metamorphic rock Olivine, Muscovite, Quartz and Feldspar are normally contained in many cases, while a very small quantity of jewel mineral might be mixed in these components. This report describes the analysis of Garnet distribution in the metamorphic rock with the spatial resolution in the order of several μm by using Near Field IR spectroscopy.

Experimental

Sample is a regional metamorphic rock containing the Garnet in the tiny area, on which the mapping measurement is performed after polishing the surface of such area. Photo 1 shows the Garnet part which is shown in orange color. Different mineral component in the size of several um being mixed in the Garnet was observed as shown in Photo 2 of enlarged microscopic view.

Mapping measurement of 20 μm area was implemented, in which the white mineral component was contained.

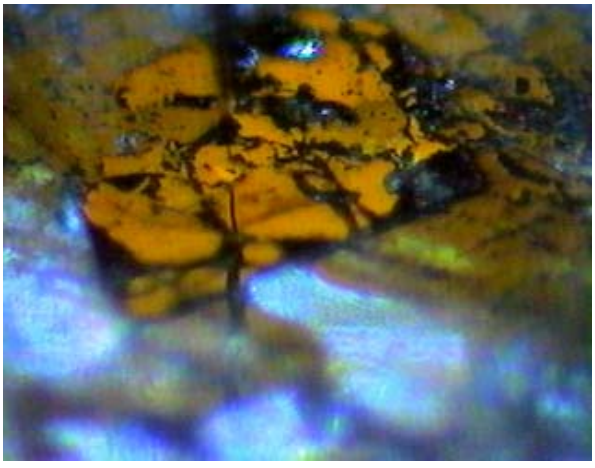

Photo 1. CCD photos of Garnet part

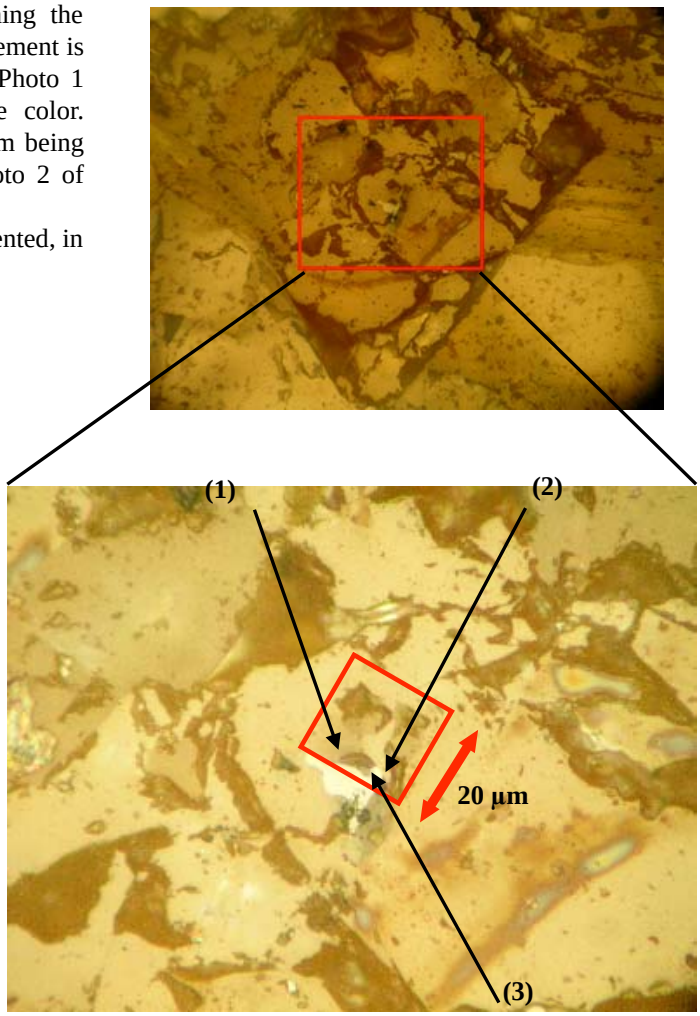

Photo 2. Microscopic view (enlarged)

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Measurement Conditions

Scattering type:	Near Field Spectrometer NFIR-200	Probe Diameter:	1 µm Measurement
Area:	20 x 20 µm	Measurement step:	1 µm step
Accumulation:	100 times	Resolution:	8 cm^{-1}

Results

The Near Field spectra at 3 points shown in the view of Photo 2 are displayed in Fig. 1 and Fig. 2. As compared with the spectrum of standard sample (by Tokyo Science), the white mineral at point 3 was determined to be the crystal of quartz (SiO2) and not the Garnet. The distinctive peaks of quartz are shown in the range of 1250 ~ 1050 cm-1 being indicated by "<=>" in Fig. 2. Chemical images of the mapping areas at each specific wavenumber are shown in Fig. 3. The quartz distribution map by 5 µm scale was obtained, and by the calculation from the spectrum intensity, the spatial resolution was confirmed to be less than 2 µm.

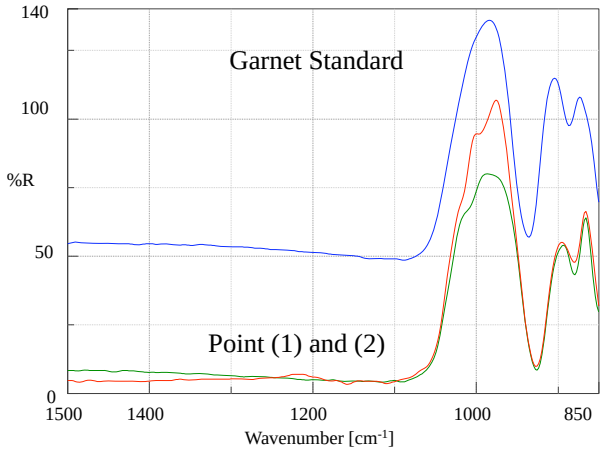


Fig. 1 Garnet standard & point (1), (2)

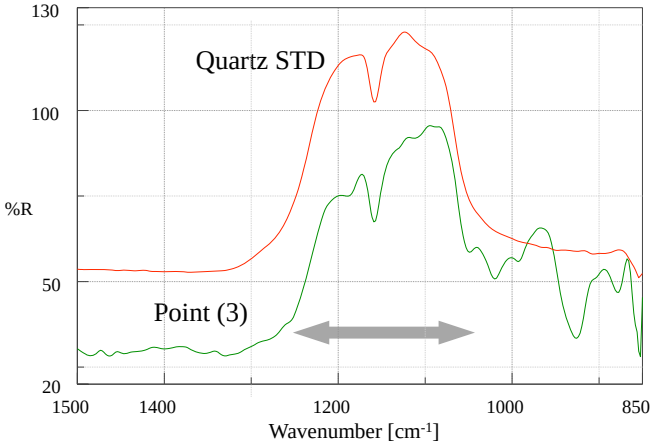
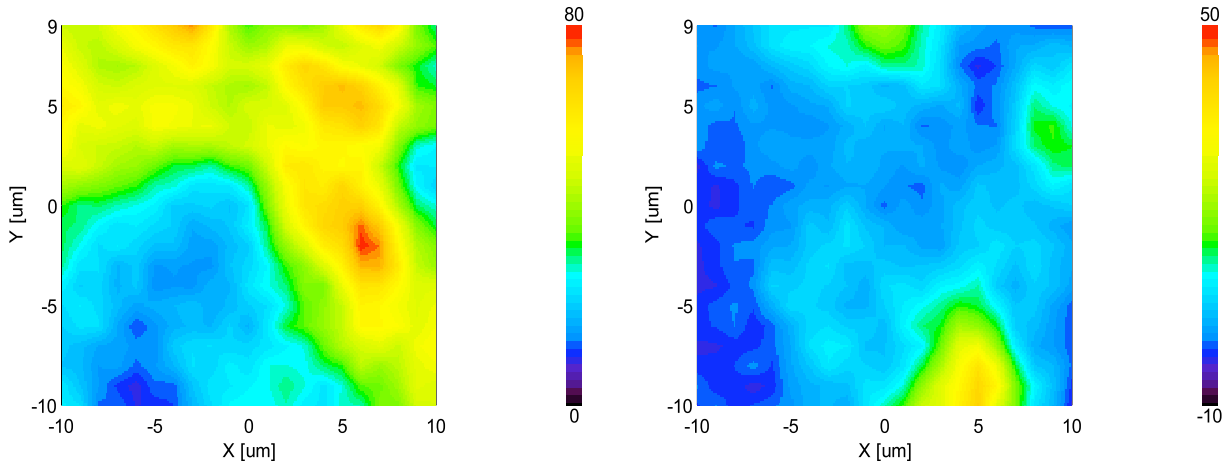


Fig. 2 Quartz standard & point (3)



Distribution of Garnet by 980 cm^{-1}

Distribution of Quartz by 1153cm^{-1}

Fig. 3 Distribution map by specific wavenumber

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