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Electrical conductivity variation of hydrous mineral and rock associated with dehydration

Kiyoshi Fuji-ta[1*], Tomoo Katsura[2], Masahiro Ichiki[3], Takashi Yoshino[4], Tomoyuki Kobayashi[5], Yasuo Ogawa[6]

[1]GSE, Osaka University, [2]Universitat Bayreuth, [3]Tokyo Institute of Technology, [4]Okayama University, [5]Kyoto University, [6]Tokyo Institute of Technology

The electrical conductivity is very sensitive to detect the phase change and can be applied for investigating the electrical properties of rock and mineral. To comprehend dehydration process within the crust and interactions between rock and geo-fluid, a large number of electrical conductivity measurements of hydrous rock should be conducted. However, few experiments have performed to detect conductivity change associated with dehydrations. We have preformed electrical conductivity measurements on sintered rock sample, raw rocks and mineral from well-known geological sites. Experimental data collected using high pressure and temperatures methods produce clear Arrhenius diagrams of various rocks and mineral. To measure the conductivity of single crystal brucite, we used single crystal sapphire capsule to avoid contamination and not react with surrounded materials. Though small amount of H_2O was formed after dehydration, bulk conductivity of the sample showed high conductivity above 700K. Basic rocks and amphibolites as a typical metamorphic rock were obtained from Higo metamorphic belt, Kyushu. These rocks were selected as being representative of mid- to lower crust. Pressures for measurement are 0.5 - 1 GPa and which represent that of the mid- to lower crust. The temperature was raised up to about 1100 K. Consequently, we found remarkable electrical conductivity variations over the metamorphic P-T conditions. The above mentioned laboratory measurements of electrical conductivity for hydrous rock and hydrous mineral help us to interpret dehydration process within the crust. Using these laboratory data, we have tried to estimate the total amount of geo-fluid after dehydration based on the effective medium theory. Further research on conductivity of crustal rock and mineral are necessary to get a better understanding of the dehydration within the crust.

Keywords: dehydration, brucite, amphibolite, fluid, crust