Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

MIS31-P01 Room:Convention Hall Time:May 27 18:15-19:30

Specific Surface Free Energy of Celestine

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The morphology of crystal is determined by the stability of each crystal face. Especially, Wulffs relationship is well known: growth length of the crystal face is proportional to the specific surface free energy (SSFE) of the crystal face. Though SSFE is theoretically discussed, experimental determination of SSFE is very few. We calculated the SSFE of some single crystals using contact angle of liquid droplets. We observed some sulfates such as, gypsum, anhydrite, and barite. This time we observed celestine (SrSO4), and determined the SSFE of natural and polished face in order to discuss stability of each face. Though natural celestine crystal do not have (001) face, the natural celestine crystal was cut and polished in order to produce (001) face. SSFE of (210) and (001) faces were 25.3 and 51.2 mN/m. SSFE of (210) face was much smaller than that of (001) face, indicating that (210) face is more stable than (001) face. Dispersion component which causes van der Waals force and polar component which causes permanent dipole moment interaction of SSFE were obtained separately. Dispersion and poplar component for SSFE of (001) face was 47.9 and 3.3 mN/m, respectively. On the other hand, they were 13.0 and 12.3 mN/m for the SSFE of (210) face. (001) face of celestine is considered to be neutral face and the dispersion component for the interaction between liquid and solid is dominant. Though contact angle of liquid is macroscopic value, we can discuss microscopic, as atomic scale structure of crystal face.

Keywords: celestine, surface free energy