Color changes of basaltic scoria powders under controlled oxygen fugacity conditions

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Volcanic materials often exhibit reddish colors and this red coloring is considered to be due to the high temperature oxidation processes (Yamanoi et al., 2004). This color change processes of volcanic materials are expected to provide a time-scale of volcanic eruption based on some laboratory experiments (Tait et al., 1998; Miyagi and Tomiya, 2002). These color change experiments were performed under only normal atmosphere, and no experiments have been conducted under lower oxygen fugacity conditions closer to natural eruptive conditions. Therefore, in this study, we have conducted color change experiments of basaltic scoria powders under controlled oxygen fugacity conditions. Their colors have been measured by spectro-colorimetry and described in color values of L∗(white), a∗(red) and b∗(yellow).

The scoria powders, whose mean diameter is about 10 micrometer, were heated in a furnace with flowing gas mixtures of nitrogen and oxygen (oxygen contents are 21, 2, 0.1 and 0.001 vol%) at 900 C for 1, 3 and 5 hours. The L∗(white) values of heated scoria did not change significantly with heating time under all the studied conditions. Color changes in a∗(red) and b∗(yellow) values were observed and different between high and low oxygen conditions. Under conditions with oxygen contents higher than 0.1 vol%, a∗(red) and b∗(yellow) values increased with heating time. The color change trends (b∗/a∗ratio) were not dependent on oxygen contents. a∗(red) value increase rates decreased with decreasing oxygen fugacity. On the other hand, under a condition with oxygen content of 0.001 vol%, b∗(yellow) value decreased with heating time, while a∗(red) value increased slightly.

Based on these experimental results, color change kinetics of basaltic scoria powders under lower oxygen fugacity conditions will be discussed.