# Development of an automatic volcanic plume sampler for UAV to determine the temperature of fumaroles remotely in Aso volcano

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Molecular hydrogen ($H_2$) in fumarolic gases shows the hydrogen isotope exchange equilibrium with coexisting $H_2O$ at a temperature more than 400 degreeC. Recently, we developed a new remote temperature sensing using the characteristics of $D/^1H$ ratio of $H_2$ (HIReTS). In this method, the $D/^1H$ ratio of fumarolic $H_2$ is obtained remotely from the observation of volcanic plume, and the outlet temperature of the fumaroles is estimated from the $D/^1H$ ratio, assuming that the hydrogen isotope exchange equilibrium is quenched within volcanic plume during the process of admixture between fumarolic gases and air. In the previous studies applying HIReTS in Aso, Satsuma-Iwo, and Sakurajima volcano in Japan, the volcanic plumes were taken manually either at the rim of each volcanic crater or in air using manned aircraft. Such manual samplings either at the rim of each volcanic crater or in air using manned aircraft, however, is neither practical nor safe in highly active, eruptive volcanoes. As a result, we developed an automatic volcanic plume sampler for UAV (Unmanned Aerial Vehicle) to take the samples of volcanic plume in safety area distant from fumaroles, for the aim of applying HIReTS to highly active volcanoes.

Keywords: fumarolic gases, volcanic plume, molecular hydrogen, UAV, automatic volcanic plume sampler , Aso volcano

 