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Study on deposition behavior of natural volcanic ash inhaled from air intake of gas turbine

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Abstract

Japan has the special feature that there are a lot of natural disasters compared with other country. The volcanic explosion at Mt. Fuji has been paid attention recently. The anxiety is a possibility that the volcanic ash spouted out might be fallen in the whole Kanto area including the capital city Tokyo. Especially, the site of all land-based gas turbines utilized as power generator is mainly concentrated in Tokyo bay. If aerosol-like volcanic ash is inhaled from the air intake in those land-based gas turbines, all generators would be stopped and then a blackout would be occurred in the whole Kanto area. In this study, deposition behavior of volcanic ash under a high-temperature gas flow was examined. In order to achieve this purpose, the volcanic ash deposit simulator, which can simulate a combustion flow, was developed. Subsequently, the volcanic ash deposition test was conducted, and a high-temperature exposure test was also performed for the ash-deposited sample.

Fig.1 shows picture of the volcanic ash deposit simulator. A working gas which was introduced by compressor was heated up by electric furnace. Using this high-pressure gas, the volcanic ash was impacted onto the Type 304 stainless-steel plate-shaped sample.

As the test condition, gas pressure was varied between 0.4 and 1.3MPa, gas temperature was also varied between 300 and 474K. As the deposition results, the amount of the volcanic ash deposited onto the sample was increased with the gas temperature. The amount of volcanic ash reached maximum value in the range of 0.7~0.9MPa.

Fig.2 shows cross section of the plate-shaped sample exposed at 873K for 100h after the deposition test. From this observation result, it was recognized that the plate surface is plastically deformed by the volcanic ash penetration and some of constituent elements of the volcanic ash is infiltrated into the sample.

Thus, the volcanic ash particle was adhered mechanically onto the sample surface, and a high-temperature corrosion attack was accelerated with the volcanic impact.

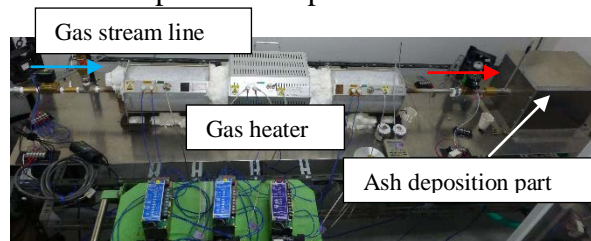


Fig.1 Volcanic ash deposit simulator

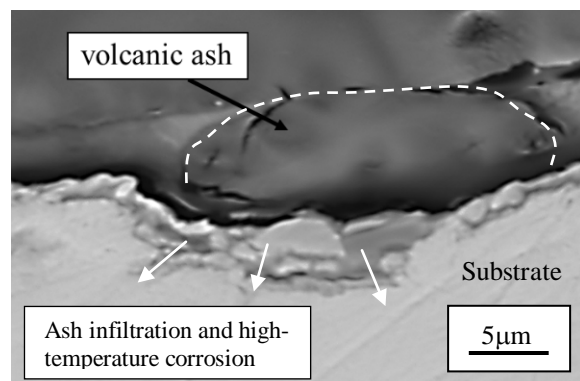


Fig.2 SEM observation of ash –deposited after heat treatment