Three-dimensional reconstruction of leaked gas cloud image based on computed tomography processing of infrared measurement data

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Abstract

The current gas leakage source detection was conducted by the human senses and experience. The development of remote gas leakage source detection system is required. In this research, infrared camera was used to detect gas leakage. The gas can be detected by the absorption of infrared rays by the gas and the infrared rays emitted from the gas itself. Three-dimensional reconstruction of leaked gas cloud was performed to identify the gas leakage source. The 3D reconstruction of leaked gas cloud was performed by the multiple optical paths of infrared measurement and inverse tomography analysis. ART (Algebraic Reconstruction Techniques) method was applied to reconstruction. In the experiments, the gas concentration distribution was simulated by the arrangement of gas cells. It was found that the gas concentration distribution composed by gas cell could be estimated by infrared images obtained with few optical path and ART method. Next, the leaked gas was taken from multiple directions using four infrared cameras, and the three-dimensional reconstruction of the leaked gas was carried out from the infrared absorption image of the gas. As a result, the spatial distribution and the temporal change of the gas could be reconstructed, respectively.

Keywords: Infrared camera, Leaked gas cloud, Computed tomography