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Technical identification methods for fire investigation - Part 7: X-ray imaging analysis

火灾技术鉴定方法 第7部分：X射线影像分析法

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Foreword

This document complies with the provisions of GB/T 1.1-2020 "Standardization Work Guidelines Part

1.Structure and Drafting Rules of Standardization Documents". Drafting. This document is Part 7 of GB/T 18294, "Methods for Fire Technical Identification". GB/T 18294 has the following parts published.

1.Ultraviolet Spectroscopy;

2.Thin-layer chromatography;

3.Gas Chromatography;

4.High Performance Liquid Chromatography;

5.Gas Chromatography-Mass Spectrometry;

6.Infrared Spectroscopy;

---Part 7: X-ray Image Analysis. Please note that some content in this document may involve patents. The issuing organization of this document assumes no responsibility for identifying patents. This document was proposed by the National Fire and Rescue Administration. This document is under the jurisdiction of the National Fire Protection

Standardization Technical Committee (SAC/TC113). This document was drafted by: Tianjin Fire Research Institute, Ministry of Emergency Management; Shenyang Fire Research Institute, Ministry of Emergency Management; and Shanghai Fire Research Institute, Ministry of Emergency Management. Research Institute, Sichuan Fire Research Institute of the Ministry of Emergency Management, Tianjin Fire and Rescue Corps, Hunan Fire and Rescue Corps, Guangdong Fire and Rescue Corps Team, Hebei Provincial Fire and Rescue Corps, Guangxi Zhuang Autonomous Region Fire and Rescue Corps, Tianjin Sanying Precision Instruments Co., Ltd. The main drafters of this document are. Zhang Bin, Chen Ke, Wang Xuanlei, Guo Yuhang, Guo Ge, Zhao Hui, Liu Haiyan, Liu Xinghua, Xia Dawei, Zhang Lei, and Wang Lifen. Shi Lihui, Luo Haisheng, Yang Shidi, and Wu Zonglin.

Fire technical appraisal is a specialized process conducted to standardize the scientific analysis of physical evidence in fire investigations and to support the determination of fire causes and liability. Professional and technical activities. To ensure the standardization, accuracy, and uniformity of fire technical appraisal work, establishing technical rules for various appraisal methods has become essential. This is a core task of standardization work in the field of fire investigation. Within this standard system, GB/T 18294 "Methods for Fire Technical Identification" refers to... A series of standards for fire scene technical identification activities are proposed to provide a systematic and operable technical basis for the identification of residual evidence at fire scenes. It consists of seven parts.

1.Ultraviolet Spectroscopy. The purpose is to establish a basis for the identification of common flammable liquids and their combustion residues at fire scenes. Technical rules for ultraviolet characteristic absorption spectra.

2.Thin-layer chromatography. The purpose is to establish a method for identifying common flammable liquids and their combustion residues at fire scenes, based on... Technical rules for thin-layer plate separation and characteristic spot comparison.

3.Gas Chromatography. The purpose is to establish a method for identifying common flammable liquids and their combustion residues at fire scenes, based on... Technical rules for capillary chromatographic separation and characteristic peak comparison.

4.High Performance Liquid Chromatography. The purpose is to establish methods for identifying common flammable liquids and their combustion residues at fire scenes. Technical rules based on high performance liquid chromatography separation and comparison of characteristic retention times and peak response values.

1 Scope

GB/T 18294.7-2026 is the Chinese national standard covering radiographing fire debris - looking inside a fused, corroded lump of wreckage at the conductors, contacts and components within it without disturbing them, which is often the only way to tell an electrical cause from an electrical consequence. Part 7 of the series, first edition of this part, in force

since 1 October 2026. It was issued on 31 March 2026 and takes effect on 1 October 2026, as a first edition. The document is under the responsibility of the National Fire and Rescue Administration. This page is published from the official record of the 2026 edition; the clause text of a standard this recent is not yet in circulation, and the figures, limits and tables it contains are those of the document itself, delivered in full with the English translation.

This document defines the terminology and definitions of X-ray imaging analysis in fire technical identification methods; establishes the principles of this method; and stipulates... It outlines the requirements for equipment and samples, methods and procedures, result determination, and expression. This document applies to trace evidence such as copper, aluminum, iron and their alloy conductors, batteries, electric heating appliances, and circuit boards extracted from fire scenes, and to... The identification of samples. When using portable X-ray equipment to perform morphological and qualitative analysis of trace evidence at fire scenes, refer to this document. use.

4.Principles When X-rays are projected onto fire-remains samples (hereinafter referred to as "samples"), some are absorbed and scattered, while the rest pass through the sample. The sample continues to propagate along the incident direction. The sample is a mixture of various materials, including metals, plastics, and fabrics, after being burned. Due to the different internal structures and materials... Materials vary in density, thickness, etc., resulting in different absorption and scattering of X-rays projected onto them, thus affecting the intensity of X-rays passing through the sample. The intensity distribution changes. This change carries information about the sample, which is then converted into data by the acquisition, conversion, and display system. The intensity distribution of visible light can be displayed on a monitor as an X-ray image of the internal structure of the sample. Analysis of the internal structure image of the sample... The characteristics can be used to determine the conditions and factors that led to its formation, provide relevant identification conclusions, and offer evidence for the determination of the cause of the fire.

5 Equipment

5.1 Composition An X-ray imaging system mainly consists of an X-ray generator, an X-ray detection device, an image processing system, an image display unit, and mechanical components. It consists of a structure and protective devices, etc.

5.2 Technical Requirements

5.2.1 The spatial resolution of the X-ray imaging system should be no less than 4 lp/mm, and the low contrast resolution should be no greater than 2.3%. Note

1.Spatial resolution, also known as line-pair resolution, refers to the highest spatial frequency in a specified set of test charts that an X-ray imaging system can resolve. It is usually expressed in units of... The number of resolvable line pairs within a distance. Note

2.Low contrast resolution, also known as density resolution, refers to the lowest contrast detail of a specified object that can be distinguished under uniform background conditions.

5.2.2 The maximum tube voltage of the X-ray generator should be no less than 130kV, and the radiation output should be stable.

5.2.3 Under operating conditions, the reference control level of dose equivalent rate outside the protective device of the X-ray imaging system should not exceed 2.5 μSv/h.

6.1 Selection

6.1.1 Examine the submitted samples and select those that can prove the cause of the fire for X-ray image analysis.

6.1.2 When disassembly may lead to changes in the internal structure, X-ray image analysis can be performed directly on the submitted sample.

6.1.3 Ensure that the physicochemical properties of the sample do not change under X-ray irradiation; if the sample undergoes physicochemical changes under X-ray irradiation... If the nature of the change is altered, the change should be predictable and should not have a significant adverse impact on the equipment and related personnel, nor affect subsequent analysis.

6.1.4 Ensure that the size and weight of the sample are within the limits allowed by the equipment.

6.1.5 Ensure that the sample does not crack or break, and prevent some sample from falling into the sample chamber and affecting the normal operation of the equipment.

6.2 Cleaning and Recording

6.2.1 Clean the selected samples and record the external characteristics of the samples before and after cleaning using methods such as photography, for the purpose of recording internal and external characteristics. Comparative analysis.

6.2.2 During the cleaning process, the focus should be on removing high-density deposits such as metal that may obstruct the key areas to be observed, ensuring that the key areas of the sample are clear. The key parts are not damaged.

6.2.3 Record the placement of the sample in the sample chamber.

7 Methods and Steps

7.1 Sample Placement Place the sample securely on the sample stage, ensuring that the sample does not shift relative to the sample stage.