



# Standard Guide for X-Ray Fluorescence (XRF) Spectroscopy of Pigments and Extenders<sup>1</sup>

This standard is issued under the fixed designation D5381; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This guide covers the general considerations for proper use of X-ray fluorescence (XRF) spectroscopy. Because many differences exist between XRF instruments, no detailed operating instructions are provided. The analyst should follow the instructions provided by the manufacturer for his instrument.

1.2 The analyst is encouraged to consult the chemical literature, various trade journals, pigment supplier publications, etc., as well as the instrument manuals from the manufacturer.

1.3 XRF is commonly employed to determine the elements present in inorganic pigments and extenders, often in concert with other analysis techniques. Organic pigments cannot normally be identified solely by XRF. On occasion, organic pigments contain heavier elements that can distinguish between major classes of these pigments or may serve to distinguish one of the two distinct pigments. However, the analyst should be wary of a qualitative pigment identification solely by XRF technique.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* For specific hazard information see Section 3 on Radiation Concerns.

## 2. Referenced Documents

- 2.1 *ASTM Standards:*<sup>2</sup>  
D3925 Practice for Sampling Liquid Paints and Related Pigmented Coatings

<sup>1</sup> This guide is under the jurisdiction of ASTM Committee D01 on Paint and Related Coatings, Materials, and Applications and is the direct responsibility of Subcommittee D01.21 on Chemical Analysis of Paints and Paint Materials.

Current edition approved July 1, 2014. Published July 2014. Originally approved in 1993. Last previous edition approved in 2009 as D5381 – 93 (2009). DOI: 10.1520/D5381-93R014.

<sup>2</sup> For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

## 3. Radiation Concerns

3.1 Modern XRF instrumentation has been designed to minimize exposure of laboratory personnel to X-ray radiation during instrument use. However, most laboratories use dosimetry to monitor personnel who are normally present around the XRF instrument while it is in operation. Such dosimetry devices are normally read on a monthly basis.

3.2 After XRF instrument maintenance (especially where the X-ray tube, detector, or shielding has been moved or replaced), an X-ray survey of all areas around the instrument (while in operation) is recommended. The results of such a survey should be documented and stored for future reference.

3.3 It is recommended that the laboratory check its compliance with all applicable local, state, and federal requirements. Many companies also have policies concerning use of X-ray equipment in their laboratories.

3.4 It is common laboratory practice to post placards on all entrances to the laboratories containing X-ray equipment that indicate its presence.

## 4. Summary of the Guide

4.1 A general guide for qualitative elemental analysis of paint and paint components is provided. Knowledge of the elements present in a sample can be used to infer the identity of pigments and extenders that may be present. The absence of specific pigments and extenders can be proven by the absence of their constituent elements. The presence or absence of toxic elements can be demonstrated. Analysis consists of irradiating the test specimen with monochromatic X-rays and determining the energy or wavelength of the fluorescent X-ray emitted by the specimen. Since different elements emit X-rays with different energy and wavelength under these conditions, the element content of the specimen can be determined by examination of the X-ray spectrum. The spectrum is recorded either on chart paper or magnetic media. Identification of the constituent elements is accomplished by comparing the peaks in the spectrum with known tabulated data, using either manual or computer-assisted procedures.

## 5. Significance and Use

5.1 The identification of pigments in a sample of liquid paint or paint film is often important for regulatory purposes.