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Illuminating
ENGINEERING SOCIETY

APPROVED METHOD: OPTICAL AND ELECTRICAL MEASUREMENTS OF FAR UV-C EXCIMER SOURCES

AN AMERICAN NATIONAL STANDARD

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should be directed to IES.

Prepared by
The IES Testing Procedures Committee

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ENGINEERING SOCIETY

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1.1 Introduction

The ultraviolet-C (UV-C) spectrum is typically defined as being from 100 nm to 280 nm. This spectrum can be further divided into other defined UV-C ranges, such as vacuum-UV (100 nm to 200 nm) and far UV-C (200 nm to 230 nm). While "far UV-C" is not officially defined, this is the meaning of the term as used in this document.

The use of far UV-C optical radiation sources in various disinfection applications is a subject of increasing interest. The main reason is that this region of the UV spectrum (200 nm to 230 nm) offers a high rate of pathogen reduction, with much lower photobiological risk than that of longer-wavelength UV devices, and without the problems associated with ozone generation at shorter UV wavelengths.

Far UV-C optical radiation is commonly produced by excimer sources (krypton bromide, KrBr*, and krypton chloride, KrCl*). (The asterisk in the symbol indicates that the molecule is an excimer; see **Section 3.4 excimer lamp**). However, other radiation sources, such as LEDs, are expected to become available in the future.

Excimer lamps work on the principle of a dielectric barrier discharge. A short pulse of electrical high-energy discharge is formed in a quartz vessel that is filled with a rare gas (e.g., krypton or xenon) and typically with an additional small amount of a halogen (chlorine, bromine, or iodine). Within the high-energy discharge, excimers are formed that will emit specific wavelengths during decay. It is important to note that although the main energy is emitted at the typical wavelength of the filling mixture (e.g., 222 nm with KrCl* and 207 nm with KrBr*), there is radiation at wavelengths outside of the far UV-C range (i.e., shorter than 200 nm and longer than 230 nm).

The discharge vessel does not contain inner electrodes, and energy is supplied through a capacitive discharge by applying electrodes to the outside of the vessel. The drivers of such excimer lamps are always specific to a particular type of lamp. Typically, the drivers supply very high voltage pulses (2 to 30 µs long), on the order of 2 to 10 kV, depending on lamp power and design.

1.2 Scope

This Approved Method considers the specific measurement challenges and characteristics of far UV-C optical radiation sources and does not focus on the measurement of energy efficacy but on application-relevant data such as electrical, irradiance, spectral distribution, and angular distribution of the optical radiation source, including the driver. The main reason for this different approach (compared to that used for other UV-C optical radiation sources, like UV-C LEDs and low-pressure mercury lamps) is that other reliable measurement methods (e.g., in a sphere) to measure total output power in the far UV-C range are not yet established.

This document describes the procedures to be followed and the precautions to be observed in performing uniform and reproducible measurements of the electrical and ultraviolet optical radiation characteristics of far UV-C excimer sources predominantly emitting at a peak wavelength within the far UV-C range (200 nm to 230 nm). The wavelength range for the purposes of this document is 200 nm to 300 nm.

This Approved Method does not address changes in optical radiation properties over time.

This approved method does not address the measurement for the production of ozone.

This standard does not address the safety concerns associated with making these measurements. It is the responsibility of the user of this standard to establish appropriate safety and health practices. Additional information on safety with respect to UV radiation may be found in *ANSI/IES RP-27.1-22, Recommended Practice: Risk Group Classification and Minimization of Photobiological Hazards From Ultraviolet Lamps and Lamp Systems.*[1]

2.0 Normative References

2.1 ANSI/IES LM-75-19

Approved Method: IES Guide to Goniometer Measurements,