Computer High-Voltage Corona Recognition Analysis Based on Ultraviolet Imaging Technology

Chun He¹,*

¹State Grid Tianjin Electric Power Maintenance Company, Tianjin, China

*Corresponding author e-mail: Hechun@tj.sgep.org

Abstract. Ultraviolet-visible high-voltage corona recognition tends to have no mechanical moving parts, integration and solid state to complete the complex, high-temperature and high-pressure detection site. At the same time, it must have the characteristics of fast detection speed, reliable data and high reproducibility. Among them, the miniaturization and solidification of ultraviolet-visible high-voltage corona recognition are mainly reflected in the dispersion system and the miniaturization of the overall structure is mainly reflected in the miniaturization of the input and output system, the miniaturization of the light source and the optical fiber connection between the probe and the instrument. The input and output system uses a touch screen to avoid the problem of large volume caused by the separation of the input and output system; the light source adopts an optical fiber light source to achieve miniaturization; the probe is selected to be placed outside the instrument and connected with the instrument by optical fiber to achieve long-distance measurement. From the perspective of the development of high-voltage corona recognition, the use of solid-state design array detectors can make high-voltage corona recognition a measurement and analysis device widely adapted to various fields. Technically, the use of optical fiber technology can make the configuration of high-voltage corona recognition flexible and portable; in design, modularization and optical fiber can make high-voltage corona recognition freely constructed; in terms of development concept, computer technology can make high-voltage corona recognition automatic, Intelligent.

Keywords: Ultraviolet Imaging, Computer, Corona

1. Introduction

Today, with the continuous development and improvement of science and technology, researchers from various countries have carried out a series of experimental explorations on transmission line related technologies, hoping to make the existing transmission line structure more perfect, strengthen the overall efficiency of transmission technology related industries and fundamentally Solve problems such as the stability and development of transmission lines. In turn, the effectiveness of the entire transmission line project is solved more effectively. Thereby promoting the performance and efficiency of the transmission line in the entire application process, so that the actual meaning and function of the transmission line are comprehensively and effectively improved and the harmonious
and stable development of our society is effectively boosted. Ultraviolet-visible high-voltage corona recognition has been continuously developed at this stage. With the development of electronic technology in the future, relevant personnel have gradually developed new software, which can not only reduce the difficulty of using the instrument, but also improve the sensitivity and reliability of the instrument. Sex. If the ultraviolet-visible high-voltage corona recognition does not require more detectors during use, its work efficiency will be greatly improved. Now the UV-visible high-voltage corona recognition can not only measure high-voltage corona, but also measure solids, reducing errors. In addition, the connection of ultraviolet-visible high-voltage corona recognition via the Internet can improve communication between instruments and improve overall work efficiency [1].

2. Ultraviolet imaging technology
High-voltage equipment has local defects such as contamination, burrs, insulators, or external damage to the porcelain bottle. During operation, the field strength of the local electric field will be distorted and increased sharply, resulting in a discharge phenomenon. According to the difference of the discharge intensity, it is divided into For arc, corona and flashover. In modern physics, the essence of electric discharge means that molecules in the air release energy after a strong collision. Air molecules transition from a high-energy level to a low-energy level and the energy will be spread out in the form of ultraviolet rays with a wavelength in the range of 230-400 nm. The wavelength of ultraviolet rays is between 40 and 400 nm [2]. The ultraviolet wavelength in the sun's rays is generally above 300 nm. The area where the ultraviolet wavelength is between 40 and 300 nm is called the solar blind zone. When nitrogen in the air is ionized, the wavelength range of ultraviolet rays generated is 280-400 nm and some ultraviolet rays are in the sun blind area. The ultraviolet imaging detection instrument that collects ultraviolet rays in the range of 280-300 nm is used to detect the ultraviolet rays in the air in this wavelength range. Ultraviolet rays are captured and after complex processing, they are displayed on a large screen with image equipment generated by visible light, so as to accurately locate and monitor the discharge position and discharge intensity of the equipment in the substation [3]. The detection mode is shown in the figure below.

![Image](image.png)

**Figure 1.** Detection management system.

3. High-voltage corona recognition technology
To identify shielding and counterattack of high-voltage transmission lines, it is necessary to grasp the operating mechanism and characteristics of both. If the thundercloud is characterized by negative polarity, it carries a large amount of negative charge. If the high-voltage transmission line is shielded, the positive insulator will flashover under this influence. If it is a counterattack phenomenon, the negative lightning cloud hits the lightning protection line of the high-voltage transmission line and it will be affected by the ground resistance and the impedance of various towers and flashover will appear in the position with high voltage. Lightning carries a large negative polarity and the positive insulation is weak [4]. The AC position of high-voltage transmission lines has a constant voltage on the basis of normal operation. But once it is struck by lightning, whether it is a shielding strike or a
counterattack, the current will be affected, especially the shielding phenomenon, which constantly repeats monotonous changes and the fault characteristics mainly appear in the unipolar grounding. The corona characteristics of UHV transmission lines, the corona characteristics of the line are mainly reflected by the strength of the corona intensity and the corona intensity refers to the size of the function of the noise power that we can hear and the appearance of radio interference proportion. As mentioned above, as the electric field intensity on the surface of the wire continues to increase, the partial corona emitted from the sub-conductive clues at the bottom of the wire will slowly develop to the entire wire. In other words, it means that the intensity of the corona will follow the change of the electric field intensity and thus change. Its changing trend gradually tends to saturation. Based on this, we can conclude that the changing law of the corona intensity of the transmission line is basically the same as that of the electric field intensity of the wire. The identification scheme is shown in the figure below.

![Figure 2. Identification management system.](image)

4. Identification scheme based on computer technology

4.1. Bus discharge

The busbars used in substations are generally stranded wires or bare wires with round or rectangular cross-sections. Its main function is to transmit, distribute and gather power resources and it occupies an important position in the substation. When the busbar in a 500 kV substation is detected by ultraviolet imaging detection technology, the detection distance is set to 10 m, the gain is set to 140 and the discharge phenomenon is judged based on the number of photons detected. If it is tested in the weather with high humidity, in order to accurately determine the defect level, it needs to be tested again when the weather is dry [5]. By comparing the results of the two tests, if the monitoring result of the latter shows If the discharge phenomenon is not obvious, it does not need to be processed; otherwise, the discharge point detected by the bus bar needs to be processed accordingly, such as smoothing the burr to eliminate the hidden danger of discharge. The connection method is shown in the figure below.
4.2. Isolating switch discharge
Isolating switches are widely used in high-voltage switchgear in substations, mainly acting as isolation circuits and their structure and working principle are relatively simple. However, because it is widely used in substations and its reliability requirements are relatively high, it has a very large impact on the stable operation of substations. It is very important to strengthen the detection of the discharge phenomenon of the isolating switch. Isolating switches are easily affected by the surrounding environment, resulting in burrs, pollution or rust, etc., causing uneven electric field distribution during operation, resulting in discharge. If the discharge phenomenon is serious, it will cause the isolating switch to fail to work normally, thus losing the function of the isolating circuit, which will have a huge impact on the stable operation of the substation [6]. For example, when monitoring an isolating switch in a 220 kV substation, the detection distance is set to 10 m, the gain is set to 150 and the number of discharge photons detected by Juyi makes a preliminary assessment of its discharge phenomenon and then combines infrared measurement Temperature, accurately determine the discharge point and discharge properties.

5. Conclusion
Ultraviolet-visible spectrophotometry has made great progress in both instrumentation and technology, continuously expanding its application fields and achieving more significant application results. Ultraviolet-visible high-voltage corona recognition has realized miniaturization and solid-state and the accuracy and repeatability of wavelength, scanning rate, stray light and other technical indicators are stable and good. The combination of UV-Vis spectrophotometry and other technologies has the advantages of high sensitivity and low detection limit. It can not only realize the direct determination of multi-component system samples without separation, but also realize non-destructive and pollution-free analysis, which has become a future development trend. The majority of scientific and technological workers will continue to explore the identification of unknown structures by ultraviolet-visible spectrophotometry.

Acknowledgement
This article is one of the research results of Study on online-monitoring Technology of Corona Discharge of Power Electric Equipment which is the science and technology project (KJ20-1-50) of State Grid Tianjin Electric Power Company in 2020.
References

[1] Physics- Nuclear Physics; data on nuclear physics discussed by researchers at chinese academy of sciences (design of a novel pixelated residual gas ionization profile monitor for the 320 kv high-voltage platform at impcas)[J]. Electronics Newsweekly,2020.

[2] Chemistry- Materials Chemistry; Recent research from hong kong university of science and technology highlight findings in materials chemistry (an ultrathin, strong, flexible composite solid electrolyte for high-voltage lithium metal batteries)[J]. Chemicals & Chemistry,2020.

[3] Contemporary Amperex Technology Co. Limited; patent issued for signal acquisition device for high-voltage loop, detector, battery device, and vehicle (USPTO 10,797,674)[J]. Electronics Newsweekly,2020.

[4] Energy- Energy Materials; new findings from chinese academy of sciences in energy materials provides new insights (6.0 v high-voltage and concentrated electrolyte toward high energy density k-based dual-graphite battery)[J]. Electronics Newsweekly,2020.

[5] Electronic - Power Electronics; Data from federal university santa maria advance knowledge in power electronics (single-switch high-efficiency hybrid boost-cuk dc/dc converter with high-voltage gain and low-voltage stress)[J]. Electronics Newsweekly,2020.

[6] Zhen Wang, Hui Zhong, Guowen Song. Enhancing high-voltage performance of LiNi 0.8 Co 0.1 Mn 0.1 O 2 by coating with NASICON fast ionic conductor Li 1.5 Al 0.5 Zr 1.5 (PO 4 ) 3[J]. Journal of Alloys and Compounds,2020,849.