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Part 304-1: Equipment – Sintering – Temperature measurement method for photonic sintering system

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Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this Technical Report is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all parts in the IEC 62899 series, published under the general title *Printed electronics*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

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INTRODUCTION

The purpose of this document is to describe temperature measurement methods for the photonic sintering system. In the printed electronics industry, metallic nano particles (NPs) such as gold (Au), platinum (Pt), silver (Ag) and copper (Cu) are used as the type of ink or paste to print the desired patterns on paper or polymeric film for a wide range of applications, including printed sensors, organic solar cells, printed batteries, signage, lighting and wearable devices. Additionally, various organic and inorganic inks are used, including etch resist ink, photo solder resist ink, conductive polymer ink, and quantum dot ink. The photonic sintering system is used to heat the printed inks to show a better electrical performance such as electric conductivity, hole mobility in semiconductors, etc. whose standard test methods are shown in IEC 62899-202 and IEC 62899-203.

Among the sintering techniques, the photonic sintering technique is attracting much attention as the most promising alternative sintering technique to replace conventional thermal sintering, in terms of short processing times for low temperature. The advantage of a low temperature in the printed electronics application is that there is less structural degradation of the substrate because the printing process and post sintering process are performed at the low temperature on flexible substrates like paper or polymer.

The photonic sintering system is heating equipment with one or more flash lamps, and the surface temperature of the substrate with the printed patterns and films inside the photonic sintering system is one of the major performance data. The flash lamp emits radiation with the wavelengths between UV and IR with highest intensity in the visible range. An intense pulse of radiation with a duration shorter than the thermal equilibration time of the printed inks and substrate heats the printed inks quickly enough to sinter before they transfer much energy to the substrate. The process parameter for the photonic sintering is electrical pulse energies, the pulse duration, a flash frequency and the distance between the flash lamp and the substrate.

Due to its radiative heating mechanism, the process temperature measurement method inside the photonic sintering system is ambiguous because the sintering temperature is induced by the radiation energy absorbed in the printed pattern on the on the flexible substrates Therefore, the standard temperature measurement method inside the photonic sintering system provides the means to identify and ensure a robust product. Therefore, the standardization and sharing of a consistent method for a temperature measurement method inside the photonic sintering system is an effective way to facilitate the commoditization and raise the confidence and performance of relevant equipment industry and its users.

This document is intended to assist in technical information related to the temperature measurement methods for monitoring the surface temperature of the substrate with the printed patterns and films inside the photonic sintering system. A non-contact method using an infrared camera and a pyrometer and a contact method using a thermocouple are introduced along with case studies. It will help equipment makers and its users to select a suitable method for temperature measurement to innovate on the equipment and its performance.

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Part 304-1: Equipment – Sintering – Temperature measurement method for photonic sintering system

1 Scope

This part of IEC 62899, which is a technical report, provides technical information relating to surface temperature measurement of the substrate containing the printed patterns and films applicable to the photonic sintering system used in the printed electronics industry.

2 Normative references

There are no normative references in this document.