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Terahertz spectroscopy for NDT in printed electronics

Abstract:

Recent advances in printed electronics (PE) highlight the need for efficient, in-situ, non-destructive quality control methods to ensure the reliability of flexible electronic devices. Traditional quality control methods such as optical and electron microscopy are effective but slow and limited in scope. This review explores terahertz (THz) spectroscopy as a promising solution for real-time, contactless inspection of printed electronics. By leveraging the electromagnetic properties of THz waves, particularly when paired with metamaterials, the system allows for the precise monitoring of electrical conductivity and geometrical accuracy during high-speed roll-to-roll (R2R) printing. Studies demonstrate that THz-based inspection outperforms conventional techniques, offering more accurate and scalable options for assessing ink distribution, pattern integrity, and conductivity in printed devices. As THz technology continues to evolve, it shows potential to enable closed-loop quality control systems in smart manufacturing environments.

Biography

Mariia Zhuldybina earned her PhD in Electrical Engineering in 2021 from the Ecole de technologie superieure (ETS), Montreal, QC, Canada. She is currently an institutional researcher in the Electrical Engineering Department at ETS, where her research focuses on advanced terahertz spectroscopy and its applications for development of 6G communication. Before joining ETS, she worked at the Institute of Graphic Communications and Printability (ICI), a leading research center specializing in scaling up printing technologies for industrial applications. During her time at ICI, she gained extensive expertise in printing techniques such as inkjet, flexography, and screen printing. In addition to her research, Mariia is the co-founder of TRAQC, a startup dedicated to integrating AI-assisted terahertz measurement systems into manufacturing lines for quality control.