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Hybrid conductive ink printed RFID antennas and printed heaters with secure optical features

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A multifunctional conductive ink incorporating integrated optoelectronic security features is presented for anticounterfeiting applications in printed electronics [1]. The formulation combines conductive fillers and a polymeric binder with multimodal luminescent taggants, creating a unique authentication signature intrinsically embedded within the electrically functional material. Unlike conventional security labels, the optical features are inseparable from the conductive matrix required for device operation, significantly enhancing resistance to unauthorized replication [2].

The ink was screen-printed on flexible polyethylene terephthalate (PET) substrates to fabricate functional electronic devices, including a 2.1 GHz rectangular microstrip patch antenna for RFID applications and resistive heater circuits. Under 365 nm ultraviolet excitation, the printed patterns exhibit a distinct green downconversion emission, while 980 nm near-infrared excitation generates a characteristic purple upconversion luminescence.

This multi-modal verification platform provides rapid, non-destructive authentication through visible photoluminescence and near infrared upconversion emission. The developed conductive ink demonstrates excellent adhesion, environmental stability, and printability on diverse substrates. By integrating optical security functions directly into conductive device architectures, this work offers a robust strategy for safeguarding RFID systems and printed electronic circuits while providing reliable authentication for manufacturers, regulators, and end users.

REFERENCES

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