

Technical Brief

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Multipurpose, low-cost, disposable plastic chip electrodes

Technology Summary

A multipurpose, cost effective, use and throw plastic chip electrode with unparalleled current density.

Background

Screen printed electrodes are widely used in miniaturized commercial products that can mostly be used for sensing applications in environmental, clinical or agri-food areas. However, these electrodes have poor mechanical stability, and can easily get delaminated by a mechanical jerk, high current or aging. Therefore, there is a need for an improved alternative to the widely used screen printed electrodes.

Technology description

CSIR-CSMCRI has developed a multipurpose, cost effective, plastic chip electrode (PCE) that is a bulk conducting, self-standing, composite electrode of graphite and PMMA polymer. The electrodes are prepared using a simple solution casting method. The typical size and thickness of the electrode fabricated under the reported conditions are around 6" X 6" and 0.45 mm, respectively. Based on initial characterization, a set of parameters have been derived for the successful use of these electrodes in off-laboratory conditions. The sheet can be cut into pieces of appropriate dimension for use as the working electrode in various electrochemical applications.

Market Potential

The overall biosensors market is expected to grow from USD 21.2 billion in 2019 to USD 31.5 billion by 2024, at a CAGR of 8.3% during the forecast period, driven by increase in the use of biosensors for medical and nonmedical applications & growth in POC diagnostics. The global metal and mineral market is expected to grow from \$6.32 trillion in 2020 to \$6.93 trillion in 2021 at a compound annual growth rate (CAGR) of 9.8%. The market is expected to reach \$9.02 trillion in 2025 at a CAGR of 7%.

*<https://www.thebusinessresearchcompany.com/press-release/metal-and-mineral-global-market-2021>

Value Proposition

- The PCEs can be easily customized based on the end user's need.
- The fabrication process method does not involve complicated steps which are associated with screen printed electrodes.
- Receptor/ catalyst can easily be attached chemically on the electrode surface for biosensing or electrocatalytic applications.
- The utility of these mechanically stable, bulk-conducting and high surface area electrodes have been demonstrated in various electrochemical protocols.
- Can sustain unparallel current density of up to 500mA/cm²

Applications

Surface modified PCE's can find application in electrochemical sensing of biomarkers, and other applications such as electrocatalysis and electrometallurgy

Technology status

JP2017523311 (Granted); GB2539862 (Granted) WO 2015170344; 2014DE01254

References

1. Analyst, 139 (2014) 5919-5926.
2. Biosensors and Bioelectronic, 128 (2019) 122-128.
3. ACS Catal. 9 (2019) 2334-2344.

