

# Technical Brief

Ref No: TechBrief/2021/05

## 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/cm<sup>2</sup>

### 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.

