



## Industrial Consultancy & Sponsored Research (IC&SR)

### A METHOD OF IONIZATION ON A 2D-NANOSTRUCTURED SURFACE

#### IITM Technology Available for Licensing

#### Problem Statement

- Generally, mass spectrometry has been used for a century as an analytical technique to study materials & **ionization** is the primary step in mass spectrometric analysis.
- There are many ion sources discussed in the prior arts literature like carbon **nano tubes, 1D nano structures, thermospray, sonic spray & etc.** However, said ion sources is not able to produce ion without external energy with other issues.
- Hence, there is a need to address the issues & present invention provides the solution in efficient manner.

#### Technology Category/ Market

**Technology:** 2D-nanostructured-MoS2-coated paper surface

**Industry:** Chemical, Pharmaceutical;

**Applications:** Standard coated Paper for detecting alcohol in breath;

**Market:** The global coated paper market is projected to grow, at a **CAGR of 4.5%** during **(2023-2030)**.

#### Intellectual Property

**IITM IDF Ref. 2133; Patent No: 383701**

#### Technology

- Present patent claimed a **method of ionization on a 2D-nanostructured surface.**
- Said method comprises the steps of:

1

•fabricating a 2D-nanostructured-MoS2-coated paper surface

2

•placing two silver contacts on top of the nanostructured surface & is connected to a picoammeter; &

3

•flowing protic solvents containing analytes over the nanostructured surface;

- The nanostructured surface is kept at an **inclined angle** for **free flowing** of the **solvents** to **induce a dipole-dipole interaction leading** to the dissociation of solvent molecules.
- The anions of the dissociated molecules move with the flow resulting in **charge separation**, & the movement of these negatively charged ions generate an **electrokinetic current** for ionizing analyte molecules, **without any external power source.**

#### Key Features / Value Proposition

##### Technical Perspective:

1. Proposed method facilitates **2D-nanostructured-MoS2-coated paper surface** which is fabricated as a **breath alcohol sensor** by flowing acetone over the nanostructured surface & blowing an alcoholic breath to generate an electrokinetic current due to ionized alcohol, wherein current generated over a 1x1 mm<sup>2</sup> nanostructured surface is **1.3 A/m<sup>2</sup>**.
2. The **magnitude** of the **current** varies depending on the **concentration of alcohol present in the vapor.**

##### Industrial Perspective:

1. The **2D-nanostructured-MoS2-coated paper surface** detects **uric acid levels in body fluids** when **raw urine sample** is flown over the **nanostructured surface.**
2. Provide a **2D-MoS2-coated paper-based disposable sensor** for detecting alcohol in breath.

#### TRL (Technology Readiness Level)

**TRL-4**, Proof of Concept & validated in Lab

#### Research Lab

**Prof. Pradeep T**

Dept. of Chemistry

#### CONTACT US

**Dr. Dara Ajay, Head**

Technology Transfer Office,  
IPM Cell- IC&SR, IIT Madras

**IITM TTO Website:**

<https://ipm.icsr.in/ipm/>

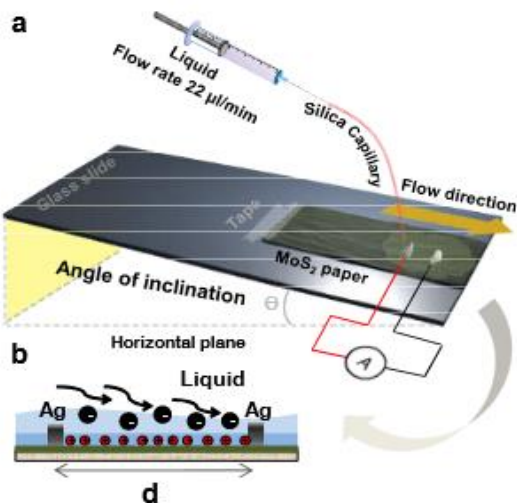
**Email:** [smipm-icsr@icsrpis.iitm.ac.in](mailto:smipm-icsr@icsrpis.iitm.ac.in)

[sm-marketing@imail.iitm.ac.in](mailto:sm-marketing@imail.iitm.ac.in)

**Phone:** +91-44-2257 9756/ 9719

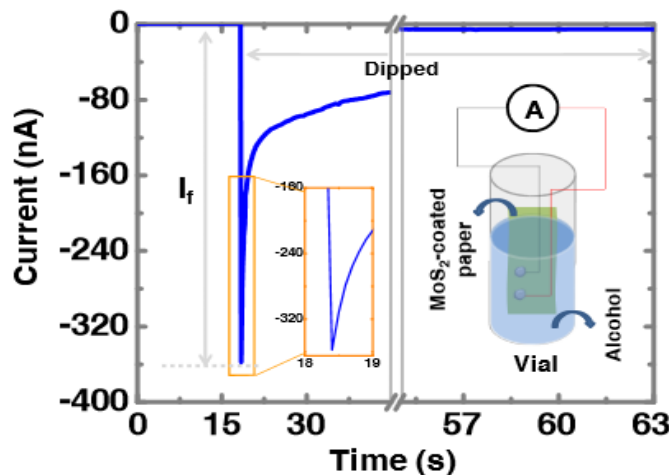
### A METHOD OF IONIZATION ON A 2D-NANOSTRUCTURED SURFACE IITM Technology Available for Licensing

#### Images with Experimental Results

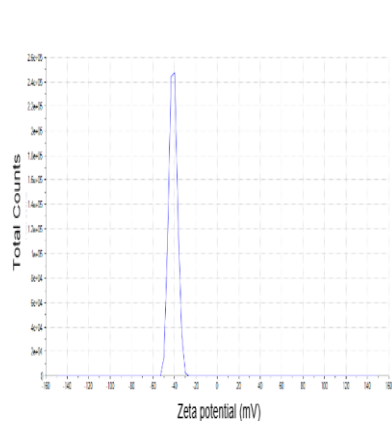


**Fig.1: Illustrates the liquid flow over MoS<sub>2</sub>-coated paper in the device,**

- Schematic representation of the device fabricated for the flow-induced current or potential generation.
- Side view of the electrode area. 'd' is the contact distance. Positive and negative ions are shown as spheres.



**Fig.2: illustrates a MoS<sub>2</sub>-coated paper dipping experiment.** The MoS<sub>2</sub>-coated paper was dipped inside a vial containing methanol and current was recorded with time. A sudden increase and subsequent fall in current was observed. The inset schematically represents the experimental setup.



**Fig.3. illustrates the zeta potential ( $\zeta$ ) analysis of MoS<sub>2</sub> in solution.**

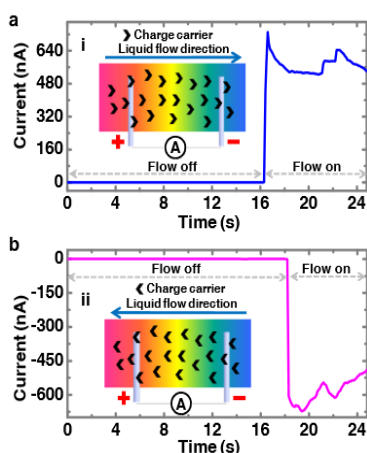
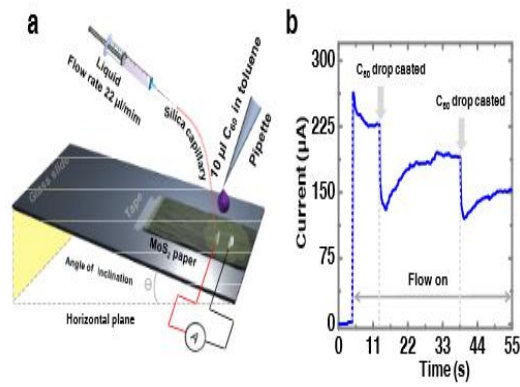


Fig. 9 illustrates the flow direction and the polarity of the current.



**Fig.4: Illustrates the effect of electron scavenging molecule during current generation.**

#### CONTACT US

Dr. Dara Ajay, Head  
Technology Transfer Office,  
IPM Cell- IC&SR, IIT Madras

IITM TTO Website:  
<https://ipm.icsr.in/ipm/>

Email: [smipm-icsr@icsrpis.iitm.ac.in](mailto:smipm-icsr@icsrpis.iitm.ac.in)

[sm-marketing@imail.iitm.ac.in](mailto:sm-marketing@imail.iitm.ac.in)

Phone: +91-44-2257 9756/ 9719