

OPTICAL SENSOR FOR HEXAVALENT CHROMIUM

IITM Technology Available for Licensing

Problem Statement

- In present era, **Chromium** is a widely used heavy metal, because of which hexavalent chromium ions are **hazardous pollutants** frequently found **in natural resources water**.
- Conventional techniques for Cr⁶⁺ detection & quantification by means of the standard methods using atomic absorption spectrometry or mass spectrometry are limited by requirement of **expensive infrastructure & skilled personnel** including other issues.
- Hence, there is a need to introduce present method which mitigate above challenges.

Technology Category/ Market

Technology: Optical Sensor for heavy metal ions
Industry: Healthcare, Food, Chemical, Manufacturing Leather, Mining. **Applications:** Drinking & wastewater quality monitoring, Blood testing, Environmental compliance and law enforcement agencies

Market: The global optical sensors market is projected at a **CAGR of 6.33%** during period of **2023-2028**.

Intellectual Property

IITM IDF Ref.:2147

Patent No. 202141023371

PCT Application No. PCT/IN2022/050375

TRL (Technology Readiness Level)

TRL- 4/5, Proof of Concept, tested & validated

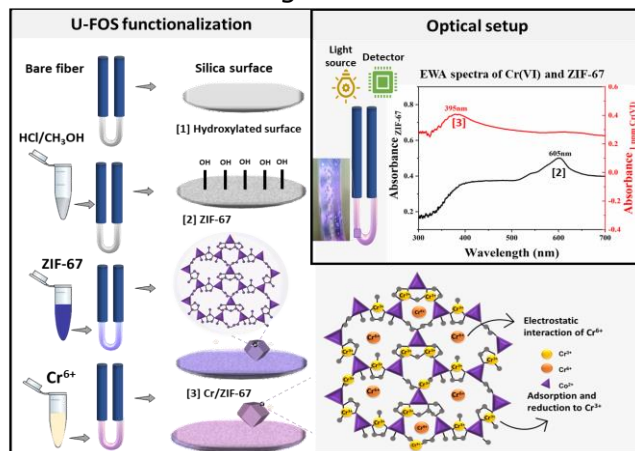
Research Lab

Biosensors Lab - Prof. Raghavendra Sai V.V,
Dept. of Applied Mechanics and Biomedical engineering

Technology

- Present invention discloses a **method of fabricating a silica optical probe** for Cr⁶⁺ detection.

- Further, said invention discussed an **optical probe** which comprises a **U-bent silica optic fiber probe** having a first end, a second end & a U-bent region, which is applicable for **detecting Cr⁶⁺**.
- Further, said **optical probe** includes a metal organic framework (**MOF**) called **zeolite imidazole (ZIF-67)** coated on an **outer surface** of the U-bent region shown in below figures.



- The **method** comprises a **few steps** explained in smart chart & Fig herein

1st Step
explains
about
Fabricating a U-bent silica optic fiber probe

2nd Step
explains
about
Activating an outer surface of the U-bent region to generate hydroxyl groups on the surface

3rd Step
explains
about
Growing a metal organic framework (MOF) and Providing post-thermal treatment to the coated probe

CONTACT US

Dr. Dara Ajay, Head

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

IITM TTO Website:

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

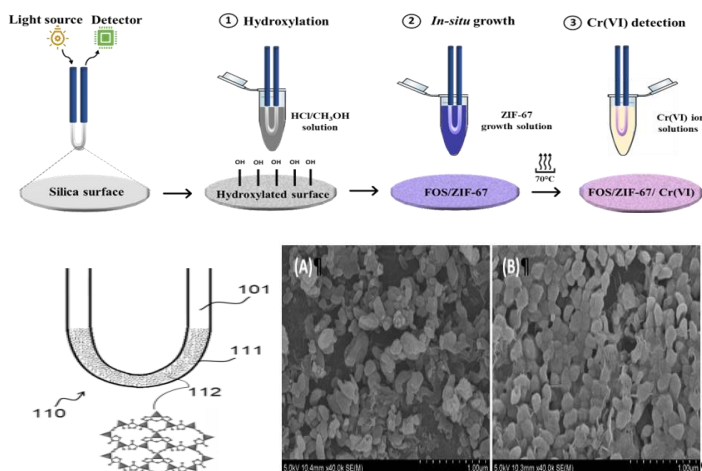
Email: smipm-icsr@icsrpis.iitm.ac.in

sm-marketing@imail.iitm.ac.in

Phone: +91-44-2257 9756/ 9719

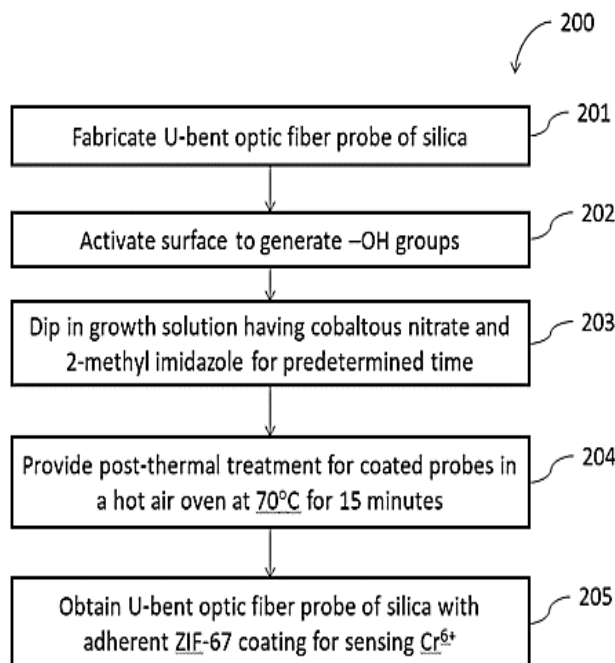
SEM Images of ZIF-67 & ZIF-67/Cr

- The invention describes about the **chemical synthesis of ZIF-67**, using 2-methyl imidazole & cobaltous nitrate hexahydrate shown in figures herein below.
- The **aqueous solution** of both chemicals is mixed in certain molarity & this **freshly prepared growth mixture solution** is used for the **in-situ growth of thin films on U-bent silica optical fiber** illustrates in figure.



Outcome of proposed Method

Fig.2 : Illustrates the method of fabricating a silica optical probe



Key Features / Value Proposition

❖ **Technical Perspective:**

- ZIF-67** selectively **entrap Cr⁶⁺ ions** and the **high EWA sensitivity** of the U-FOS allows **specific detection of Cr⁶⁺ ions** by means of their intrinsic optical absorption around **395 nm**.
- The **MOF coated fiber probes** are stable over a month even in humid and **at room temperature**.
- The claimed **sensor** demonstrates **high selectivity** for **chromium ion** detection with respect to other potential interfering heavy metal ions present in water such as **Mn⁷⁺, Fe³⁺, Co²⁺, Cl⁻, Cu²⁺, Pb²⁺, Hg²⁺, Mg²⁺, Ca²⁺, Ni²⁺, Cd²⁺, Zn²⁺, Li⁺**.
- The proposed synthesis method is advantageous for many applications where **fresh water** may be used as **medium for sensing**.

❖ **Industrial Perspective:**

- The ZIF-67 coated U-FOS Cr⁶⁺ sensor realized with a portable **LED-photodetector set-up** demonstrates a **wide dynamic range & useful detection limits**.
- Potentiality applicable to develop the **U-FOS** as a **portable on-field sensor, or applicable to any other handheld device**.

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

Email: smipm-icsr@icsrpis.iitm.ac.in
sm-marketing@imail.iitm.ac.in
Phone: +91-44-2257 9756/ 9719