A NANOPARTICLE CONTRAST COMPRISING Eu^{3+}:TaO_x AND PROCESS OF PREPARATION THEREOF

IITM Technology Available for Licensing

Problem Statement

- Doping of optically luminescent nanomaterials creates contrast agents for **hybrid imaging system that aids visualization of drug development process**
- Europium dopant in various hosts have been extensively studied as a scintillating material for X-ray detectors and also as **nano-contrast agent for optical and MRI that exhibits sharp emission peak, low toxicity, low photo bleaching and it is chemically stable**
- The existing technologies **involves lengthy process, issues with precursor mixing and dispersion, micro emulsion stability, yield etc**

Technology Category/ Market

Category – Advanced Materials

Applications –Medical Imaging Techniques, Drug delivery systems , sensors, nanotechnology

Industry – Biomedical Engineering

Market -The global advanced materials market size was estimated at USD 61.35 billion in 2022 and it is expected to hit around **USD 112.7 billion by 2032,** poised to grow at a **CAGR of 6.27% from 2023 to 2032**

Key Features / Value Proposition

Technical Perspective:

- Novel and simple synthesis for preparation of **Eu^{3+}:TaO_x nanoparticle**
- Combination of highly efficient europium and Tantalum nanoparticles for the hybrid imaging system.

User Perspective:

- Proposes use of **Eu^{3+}:TaO_x nanoparticle** as nanoprobes for simultaneous X-ray, CT, XEOL imaging etc.
- Tantalum (TaOx) nanoparticle is a promising CT contrast agent with **low cost, availability of material, highly biocompatible and easy to synthesize**

Intellectual Property

- **IITM IDF Ref. 2233**
- **IN202141062007**

Technology

- The present invention provides a nanoparticle contrast and method thereof comprising **Eu3+:TaO_x** wherein **Europium (Eu) is doped in Tantalum oxide (TaO_x);** Europium precursor is Europium (III) chloride (EuCl3) and Tantalum precursor is Tantalum (V) ethoxide
- Europium is doped in Tantalum oxide having dopant percentage ranging from 2-10%.
- The nanoparticles are quasi spherical in structure and having size ranging from 5 to 25 nm

Method involves :

Preparing an oil in water solution((2 mL of Igepal, 600 µL ethanol (99.9%) and 600 µL NaOH (75 mM))

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Formation of Micro-Emulsion Solution (20 mL of cyclohexane and incubation for 10 mins)

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Introducing Tantalum Precursor and formation of Eu3+:TaO_x

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Breaking the Micro-Emulsion Layer and Washing with acetone and ethanol

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Drying the Nanoparticles(100°C for 24 hours) to yield Europium doped TaO_x nanoparticles

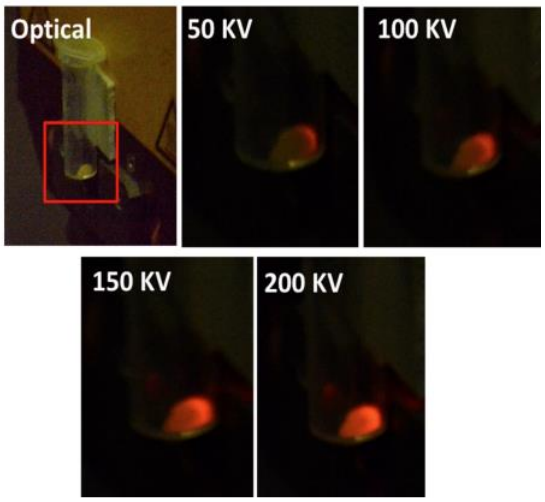

Fig. 1: Eu^{3+}:TaO_xnanoparticles with same concentration were excited X-ray at different voltages with constant current at I=1,000 µA produces red emission.

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Images

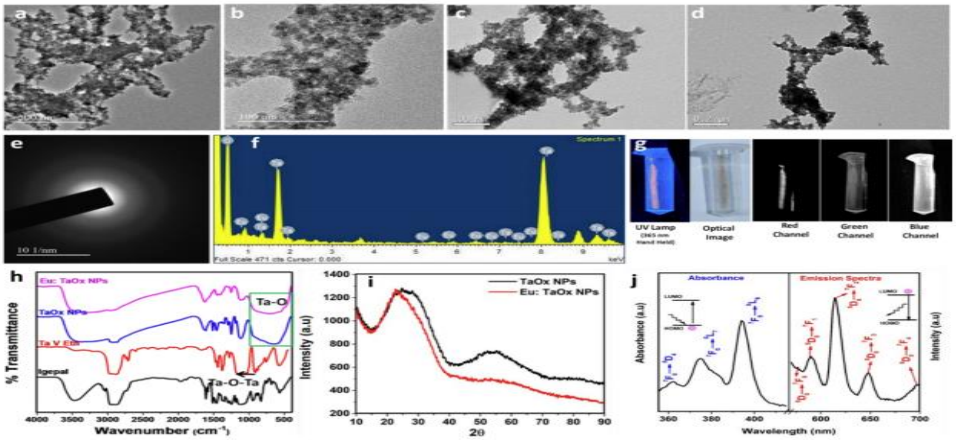
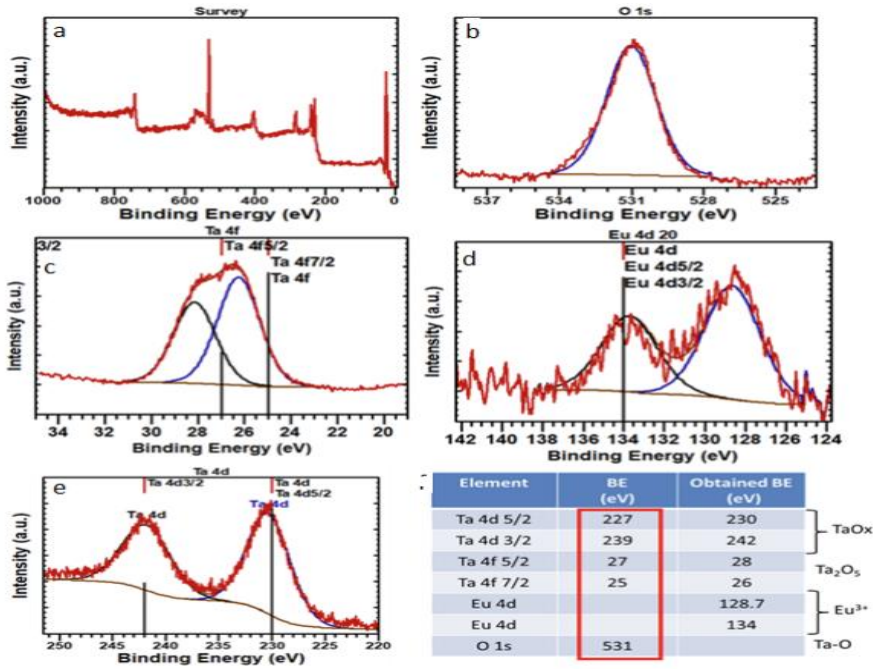


Fig.2 Transmission electron microscopic images of TaO_x doped with Europium at different magnifications (a-d); Selective area electron diffraction pattern of the amorphous Eu: TaO_x NPs (e); Elemental composition (f); UV lamp excited **red fluorescence from Eu3+: TaO_x NPs** (g); FTIR (h); XRD (i) and absorption and fluorescence spectra (j).



Element	BE (eV)	Obtained BE (eV)	
Ta 4d 5/2	227	230	TaOx
Ta 4d 3/2	239	242	
Ta 4f 5/2	27	28	Ta_2O_5
Ta 4f 7/2	25	26	
Eu 4d		128.7	Eu^{3+}
Eu 4d		134	
O 1s	531		Ta-O

Fig 3: XPS of Eu:TaO_xnanoparticles; Fig .3 (a-f) represents the wide scan and narrow scan of Eu3+ 30 : TaOx nanoparticles with corresponding binding energies shows the presence Ta, Eu, O and C

TRL (Technology Readiness Level)

TRL-4,Technology Validated in Lab

Research Lab

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