

LABEL-FREE LONG-DURATION IMAGING OF CANCER SPHEROIDS USING ELECTROCHEMILUMINESCENCE

2026-DICK-71377

PROBLEM

Current imaging of 3D tumor models in oncology research is hampered by the need for fluorescent labels, which cause phototoxicity, disrupt cellular function, and limit observation time, or by destructive sample preparation that prevents real-time analysis.

SOLUTION

This technology introduces a new, label-free method for long-duration imaging of cancer spheroids. The innovation enables sustained ECL emission for over three hours and sharper spatial resolution, eliminating the need for exogenous fluorescent tags and avoiding phototoxicity. Compared to fluorescence microscopy and mass spectrometry, this approach allows >3× longer imaging, preserves sample integrity, and integrates with standard electrochemical and imaging equipment.

VALIDATION

Proof-of-concept demonstrated with breast cancer spheroids: continuous imaging for >3 hours without phototoxicity, sustained ECL emission after potential is switched off (afterglow), and improved spatial resolution over luminol-based systems. Validation to date is in controlled lab settings.

ADVANTAGES

- Enables real-time, long-duration imaging (>3 hours) of 3D tumor models without fluorescent labels
- Reduces phototoxicity and preserves cellular integrity during imaging
- Integrates with existing electrochemical and imaging platforms
- Provides sharper spatial resolution than prior ECL or fluorescence methods
- Uses commercially available reagents and standard lab equipment

APPLICATIONS

- Drug efficacy studies using long-term imaging of tumor spheroids
- Mechanistic cancer biology research without fluorescent labels
- High-resolution monitoring of metabolic activity in 3D cell cultures
- Toxicology and pharmacokinetics studies in spheroid models
- High-content screening for personalized medicine in pharma R&D

INTELLECTUAL PROPERTY STATUS

Application Date: August 24, 2025 | **Type:** Provisional | **Country of Filing:** United States

For more information on developing or commercializing this technology, contact:

Jacob Brejcha | *Licensing Associate - Physical Sciences*
jjbrejcha@prf.org

METHOD FOR BENZOYL PEROXIDE REDUCTION AFTERGLOW ELECTROCHEMILUMINESCENCE

2025-DICK-71267

PROBLEM

Through current methods, the lifetime of ECL is limited.

SOLUTION

The new strategy further synthesizes more reactive radical salts, effectively freezing radicals in space and time for future use. This breakthrough principle increases the lifetime of ECL by orders of magnitude, increasing both the brightness and length of electroless chemiluminescence after the potential difference is ceased.

VALIDATION

Researchers demonstrated the method's ability to increase the lifetime of ECL by employing the co-electroprecipitation of two reactants during the simultaneous electro-reduction of these reactants. The electrode was shown to generate a concentration profile exceeding the solubility of the given reactants, promoting precipitant formation. After the application of a potential, the leads were disconnected, and the precipitant electrolessly chemiluminesced for minutes during dissolution.

ADVANTAGES

- Opens a path for using organic solvents in ECL reactions
- Increases brightness and length of electroless chemiluminescence after the potential is ended

APPLICATIONS

- Polymer synthesis
- Reaction confinement
- Printable electronics
- Bio-sensing

INTELLECTUAL PROPERTY STATUS

Application Date: July 29, 2025 | **Type:** Provisional: Gov. Funding | **Country of Filing:** United States

For more information on developing or commercializing this technology, contact:

Jacob Brejcha | *Licensing Associate - Physical Sciences*
jbrejcha@prf.org

AFTERGLOW ELECTROCHEMILUMINESCENCE WITH TRIS(2,2'-BI-PYRIDYL)RUTHENIUM(II) CHLORIDE AND POTASSIUM PERSULFATE

2024-DICK-70648

PROBLEM

In current ECL systems, the maximum luminescent lifetime of the $[\text{Ru}(\text{bpy})_3]^{2+}$ ion was in the microsecond range, limiting the use of these types of systems for chemical/biological assays and displays. Additionally, expanding the light production into three dimensions (rather than just on the surface of the electrode) is another sought-after characteristic due to the potential for much higher light-emission density per unit volume.

SOLUTION

The researchers developed an ECL system that, upon application of a voltage, will induce the formation of crystals starting from the electrode surface. The crystals will continue to grow, releasing photons in the process. Once the voltage is cut, light is released as the crystals dissolve back into the solution, producing a glow lasting over a minute, depending on the experimental conditions.

VALIDATION

The researchers verified the growth of the crystals from the electrode surface via a microscope, seeing the crystal growth in real time, reaching a maximum of ~170 micrometers from the surface. The vast increase in luminescent lifetime was observed by applying a potential for 100 seconds, ceasing the potential, and measuring the intensity of light released from the solution over time. The researchers observed a total luminescent lifetime of 63 seconds, after which the intensity rapidly decreases.

ADVANTAGES

- Vastly improved luminescent lifetime (from microseconds to over a minute)
- Low complexity system
- Commonly used reagents

APPLICATIONS

- Biomedical imaging
- Electrochemical assays
- Biological assays
- Displays

INTELLECTUAL PROPERTY STATUS

Application Date: July 26, 2024 | **Type:** Provisional: Gov. Funding | **Country of Filing:** United States

Application Date: July 25, 2025 | **Type:** PCT: Gov. Funding | **Country of Filing:** WO

For more information on developing or commercializing this technology, contact:

Jacob Brejcha | *Licensing Associate - Physical Sciences*
jbrejcha@prf.org