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TECHNOLOGY BRIEF

Ultra-fast, highly sensitive Metal-enhanced Chemiluminescence (MEC)

The Challenge: The attractiveness of chemiluminescence as an analytical tool lies primarily in the simplicity of detection. The fact that most samples have no unwanted background luminescence, as is typically observed in fluorescence-based assays, and the fact that no optical filters are required to separate the excitation wavelengths and scatter, as is also required for fluorescence-based detection. Chemiluminescent-based detection is, however, currently limited by the availability of chemiluminescent probes, and suffers from an inherent need for increased sensitivity/detection limits. For chemiluminescence, detection is limited by the quantum efficiency of the chemiluminescence reaction or probe, and the time before depletion of the reactants. An increased luminescence yield would clearly benefit the overall detectability and therefore, for bioassays, the sensitivity towards a particular analyte.

UMBI Solution: A UMBI scientist has discovered a new phenomenon called metal-enhanced chemiluminescence. The new discovery amplifies chemiluminescence reactions up to 50,000 fold in comparison to emissions from a control sample. The mechanism relies on the interaction of metallic surfaces (surface plasmons) with chemiluminescence and when combined with microwave focusing, even a greater enhancement in intensities can be realized. This radical new discovery is based on positioning metallic surfaces near–to the chemiluminescence-based reaction, which amplifies the electronically excited state of the chemiluminescent species, resulting in an enhanced signal. In addition, since microwaves accelerate the rate of chemical and enzyme-catalyzed biological reactions, UMBI scientists have also shown that the exposure of metallic surfaces to microwave energy further enhances emission. This platform technology is a significant advance to the entire field of chemiluminescence-based bioassays and dramatically increases the assay sensitivity, detectability and reproducibility.

Commercial Applications:

- Platform technology – Applicable to all chemiluminescence detection systems including enzyme-catalyzed biological reactions.
- Increased sensitivity of diagnostic kits.
- Increased sensitivity for detecting bands on gels and blots.

Advantages:

- Novel metal-based chemiluminescence significantly increases assay sensitivity, speed and signal-to-noise ratio.
- The addition of a metal film does not detrimentally change the background signal in reactions. Thus, the net result is increased signal to noise and increased sensitivity.

Stage of Development: Reduced to practice in the laboratory. Commercial reduction to practice primarily relating to refinements, QA/QC and commercial production of metal films.

Patent Status: Pending PCT patent application

Licensing Potential: UMBI is seeking exclusive or non-exclusive partnership for developing a new enhanced chemiluminescence-based platform. The UMBI inventor would welcome the opportunity to collaborate with any licensee to further refine the invention to a fully developed product.

Inventor & UMBI Reference: Geddes, 05-035

Relevant Publications:

1. Aslan K, Previte MJ, Zhang Y, Geddes CD. 2008. Microwave-accelerated surface plasmon-coupled directional luminescence 2: a platform technology for ultra fast and sensitive target DNA detection in whole blood. J Immunol Methods. 331(1-2):103-13.
2. Chowdhury MH, Malyn SN, Aslan K, Lakowicz JR, Geddes CD. 2007. First Observation of Surface Plasmon-Coupled Chemiluminescence (SPCC). Chem Phys Lett; 435(1-3):114-118.
3. Previte MJ, Aslan K, Geddes CD. 2007. Spatial and temporal control of microwave triggered chemiluminescence: a protein detection platform. Anal Chem. 79(18):7042-52.
4. Previte MJ, Geddes CD. 2007. Microwave-triggered surface plasmon coupled chemiluminescence. J Am Chem Soc. 129(32):9850-1.
5. Microwave-Triggered Chemiluminescence with Planar Geometrical Aluminum Substrates: Theory, Simulation and Experiment, Michael J. R. Previte · Chris D. Geddes, J Fluoresc (2007) 17:279–287.
6. Microwave Triggered Metal Enhanced Chemiluminescence: Quantitative Protein Determination, Michael J.R. Previte, Kadir Aslan, Stuart N. Malyn, and Chris D. Geddes, Anal. Chem. (2006), 78, 8020-8027.

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