

[0111] In operation, a sample comprising reagents **98** is introduced via sample inlet port **95** into reaction enclosure **94**. The reagents required for conducting an ECL assay may already have been added to the sample. Said reagents include: ECL coreagents (e.g., tripropylamine), ECL moieties (e.g., Ru(II)(bpy)<sub>3</sub> or derivatives, preferably linked to an analyte or the binding partner of an analyte), blocking agents (e.g., BSA), buffers, excipients, additives, preservatives and the like. In a preferred embodiment, the cartridge is prestored with some or all of the reagents required to conduct an assay, shown as reagents **97B**. In an especially preferred embodiment, reagents **97B** are stored in a dry form within reaction enclosure **94**.

[0112] To conduct an assay, cartridge **90** is placed in instrument **101**, sonication device **105** is structurally coupled to diaphragm **92**, and device **105** activated by source **106** to sonicate diaphragm **92**. Sonication energy is then transmitted through diaphragm **92** to reagents **98**. Depending upon the mounting of diaphragm **92**, sonication energy may also be transmitted to base **91** which will conduct such energy to reaction enclosure **94**, and thus to reagents **98**.

[0113] The sonication causes reagents **98** and reagents **97B** to mix, speeding the rate of reaction among components reagents **98** and/or **97B** and the rate of mass transfer of reagents **98** and/or **97B** to and from diaphragm **92**. Sonication energy from device **105** significantly increases the rate of mass transfer of reagents **98** and/or **97B** to support **92**, thereby increasing the rate of binding reactions between reagents **97A** and components of reagents **97B** and **98**, and decreasing the time required to make an ECL measurement. Electrical energy is applied to diaphragm **92** and to electrodes **93**, by source **104** via connector **103** and leads **96**, to cause an electrochemiluminescent moiety in reactants **97A**, **97B** and/or **98** to luminesce. The light produced by the ECL reaction may be measured (or imaged) while sonication device **105** operates or thereafter.

[0114] Microprocessor **107** controls the operation of sources **104** and **106** and receives intensity data from detector **102** along with voltage and/or current data from source **104**. Microprocessor **107** analyzes, and may store, the received data and preferably produces a corresponding output for provision to a user or to another device (not shown). Preferably, upon completion of data collection, microprocessor **107** notifies the user that cartridge may be removed from instrument **101**. Upon receiving such notification from microprocessor **107**, or otherwise determining that assay data collection is complete, the cartridge **90** is removed from device **101** and suitably disposed of or recycled.

[0115] In an alternate embodiment of system **100**, that portion of leads **96** coupled to diaphragm **92** is omitted and an electrical connection is added between source **104** and sonication device **105**. Accordingly, the corresponding connection of connector **103** may also be omitted. In this embodiment, sonication device **105** functions as the electrical connection to diaphragm **92**. When cartridge **90** is inserted into instrument **101**, electrical energy is provided through sonication device **105** to reagents **98** via diaphragm **92**. Such application of electrical energy may or may not be simultaneous with the application of sonication energy.

[0116] In an alternate embodiment, diaphragm **92** and/or enclosure **94** are pre-coated with a reagent or the like.

Sonication of electrode **92** may cause such reagent to loosen, allowing the reagent to mix with reagents **98** within enclosure **94**.

[0117] In another alternative embodiment, a dry reagent **97B** is prestored in reaction enclosure **94** and liquid reagents **98** are introduced into reaction enclosure **94** to directly contact dry reagent **97B**. Upon activation of sonication device **105**, dry reagent **97B** and liquid reagent **98** intermix at a significantly faster rate than in the absence of sonication energy. The intermixed reagents may react e.g., with each other and/or with reagents on a solid-phase support **92**, or another reagent may then be added and also intermixed. In a different embodiment, reagent **97B** is omitted.

[0118] The interior surfaces of reaction enclosure **94** may become coated with a substance that interferes with an assay. This interfering substance may include a contaminant, cellular debris, a non-specifically bound reagent, a reaction byproduct, or the like. In yet another embodiment of the invention, sonication device **105** is activated and the sonication energy removes the interfering substances from the interior surfaces of enclosure **94** by sonicating such substances to loosen or by causing increasing the rate of mass transport at the surfaces. For example, an ECL assay may use cleaning cycles involving activation of device **105** before and/or after the binding reaction to properly prepare the electrode for the excitation of ECL. These cleaning cycles may involve adding to reaction enclosure **94** a cleaning solution which assists in loosening such interfering substances.

[0119] In still another alternate embodiment, sonication device **105** and source **106** are omitted from instrument **101** and diaphragm **92** additionally comprises a sonication device like device **105**. Further, source **104** incorporates the functionality of source **106**. Electrical power from source **104** to activate the sonication device of diaphragm **92** is conducted via connector **103** and leads **96**.

[0120] In continuous or intermittent ECL measurements, the rate of a binding reaction is measured continuously or at intermittent intervals. A description of this process is found in U.S. Pat. No. 5,527,710 (Nacumulli et al.). The present invention will act to increase the rate of binding reactions in such assays, and will also provide reproducible mixing so as to provide precise and reproducible rate measurements. Sonication may also be continuous or intermittent during such assays. An advantage of continuous or intermittent measurements for determining the rate of a binding reaction is that it offers increased sensitivity and precision as compared to single-point ECL measurements.

## EXAMPLES

### Example 1

#### Preparation of Fibril-Plastic Composites

[0121] Composite plastic materials comprising carbon fibrils in a polymer matrix were prepared by methods analogous to those described in copending U.S. application Ser. No. \_\_\_\_\_ filed on even date herewith, and PCT Application No. \_\_\_\_\_ (WO \_\_\_\_\_) filed on even date herewith, both of which are incorporated by reference above. To give a better understanding of the following examples, a brief description of the steps for preparing the