may include a cleaning cycle involving activation of device **74** before and/or after a binding reaction to properly prepare support **78** (working electrode) and/or electrodes **82** (counter electrode) for electrical inducement of ECL. Such a cleaning cycle may involve the addition of a cleaning solution to reaction enclosure **80**.

[**0100**] As will be apparent to one of ordinary skill, assay cell **70** is also advantageously employed in non-ECL based assays, especially binding assays. Components of cell **70** related to the electrochemical excitation of ECL labels may be omitted from cell or remain unused in connection with assays that do not require electrochemical reactions. Similarly, some detection techniques may require the addition to cell **70** of technique-specific components, e.g., a light source for fluorescence or colorometric measurements.

[**0101**] An instrument for conducting ECL assays that includes cell **70** may also include, but is not limited to, one or more of the following: a source of electrical energy (e.g., a potentiostat, a current source or a voltage source) for applying potentials or currents between the working and counter electrodes; a source of electrical energy (e.g., a battery) along with associated electronics for driving sonication device **74**; a device for measuring light (e.g., a photomultiplier tube, one or more photodiodes, or CCD camera) generated within enclosure **80** or imaging the contents of enclosure **80**; means for sample handling and processing; a microprocessor for system control, assay data gathering, and assay data analysis; and apparatus for introducing reagent samples and additional reagents and removing waste from enclosure **80**.

[**0102**] In still another alternate embodiment, sonication device **74** is removably and/or reversibly coupled to contact **76**. Base **72**, electrode contact **76**, support **78**, enclosure **80** and electrode **82** may together comprise a separate, disposable assay cell device. An assay system **100** for conducting ECL assays in a disposable cartridge **90** with an instrument **101** is illustrated in **FIG. 7**. Cartridge **90** includes a base **91**, a diaphragm **92**, a counterelectrode **93**, a reaction enclosure **94**, a sample port **95**, electrical leads **96**, and a reference electrode **99**. Instrument **101** includes a cartridge receptacle **108**, a light detector and/or imaging device **102**, an electrical connector **103**, a source of electrical energy for applying a voltage or current between the working and counter electrodes **104**; a sonication device **105**; a source of electrical energy **106** for driving sonication device **105**; and a microprocessor **107** for instrument control, assay data gathering, and assay data analysis.

[**0103**] Diaphragm **92** is an electrically conductive solid-phase support for reagents **97**A, such as binding reagents, and functions as a working electrode. In a preferred embodiment, diaphragm **92** is a fibril-polymer composite electrode and reagents **97**A comprise binding reagents such as antibodies, nucleic acids, receptors, etc. immobilized thereon. In an especially preferred embodiment, binding reagents specific for a variety of analytes are patterned into binding domains on diaphragm **92**. Base **91** is preferably a rigid and transparent material, such as acrylic or the like, that allows light generated by an ECL reaction occurring within enclosure **94** to be detected by detector **102**. Base **91** is shaped to define reaction enclosure **94** and sample port **95**. Diaphragm **92** is preferably sealed to base **91**.

[**0104**] Electrical leads **96** are electrical contacts providing electrical coupling to diaphragm **92**, to counter electrode **93**, and to reference electrode **99**. Preferably, diaphragm **92** is mounted such that the transmission of sonication energy from device **105** to base **91** is minimized. Alternatively, diaphragm **92** may be mounted so that diaphragm **92** transmits sonication energy from device **105** to base **91**, and thereon to the entire surface of reaction enclosure **94**.

[**0105**] Preferably, reaction enclosure **94** is partially defined by the inner surface of base **91**. Alternatively, reaction enclosure **94** may comprise a separate enclosure made of a transparent material which couples to base **91**.

[**0106**] Counter electrode **93** is preferably an electrically conductive material, such as metal. Reference electrode **99** is preferably an Ag/AgCl reference electrode. Electrodes **93** and **99** are located within base **91**, are coupled to leads **96**, and are adapted to be in electrical contact with reagents **98**. Optionally, reference electrode **98** may be omitted. Aperture **95** is preferably adapted for insertion of sample material (e.g., reagents **98**) via a small tube (not shown), such as a capillary tube.

[**0107**] The inner surface of instrument **101** is adapted to receive and align cartridge **90** and its components with receptacle **108** and its counterpart components, including sonication device **105**, electrical connections **103** and detector **102**. Preferably, detector **102** is an array of detectors (e.g., a CCD camera or a photodiode array) that can image the light emitted during an ECL reaction at the working electrode. Detector **102** may be a single detector such as a photomultiplier tube, a photodiode, or the like. Insertion of cartridge **90** in instrument **101** aligns detector **102** with base **91** such that detector **102** is positioned to detect much of the light produced within enclosure **94**.

[**0108**] Sonication device **105** is a device for sonicating diaphragm **92** which transmits the sonication energy to reagents **98** contained in reaction enclosure **94**. Insertion of cartridge **90** in instrument **101** preferably aligns device **105** with the center of diaphragm **92** such that device **105** may be moved into contact with diaphragm **92**. Insertion of cartridge **90** in instrument **101** causes sonication device **105** to be structurally coupled to diaphragm **92**. It is preferred that sonication device **105** comprises a piezoelectric sonication device that may include a piston. Preferably, sonication device **105** is movable to achieve contact with diaphragm **92** when cartridge **90** is inserted into instrument **101**.

[**0109**] Upon insertion of cartridge **90** into receptacle **108**, electrical leads **96** are coupled to electrical connections **103**. The source of electrical energy **104** may be a controllable voltage or current source adapted for control by microprocessor **107**. Alternatively, if cartridge **90** includes a reference electrode, source **104** is preferably a potentiostat.

[**0110**] Controlled energy source **106** is preferably a conventional controllable electronic circuit driving device for controlling the operation of sonication device **105**. Operation of source **106** is controlled by microprocessor **107**. Microprocessor **107** is a conventional processor device, such as a software-programmed microprocessor, a microcontroller, or the like. Microprocessor **107** controls the operation of detector **102** and energy sources **104** and **106**, and receives intensity data from detector **102** along with voltage and/or current data from source **104**. Preferably, microprocessor **107** is additionally capable of processing the assay data and providing a corresponding output to a user and/or to another device.