

**ELECTROPHORETIC MOBILITY
MEASUREMENT CELL AND
MEASUREMENT APPARATUS AND METHOD
USING THE SAME**

FIELD OF THE INVENTION

[0001] The present invention relates to an electrophoretic mobility measurement cell and an electrophoretic mobility measurement method using the cell.

BACKGROUND OF THE INVENTION

[0002] An apparatus that measures the electrophoretic mobility and the ζ (zeta) potential of particles that are contained inside a sample cell container and move under the influence of an electric field is called an electrophoretic mobility measurement apparatus.

[0003] With this measurement apparatus, a liquid (sample solution), in which a dispersion of particles is suspended, is contained in a cell-type test container having transparent walls (hereinafter referred to simply as "sample cell container"), light is irradiated on the sample solution, scattered light emitted from a certain region of the sample cell container is detected by a photodetector, the velocity of the particles is calculated by analyzing the frequency components of the scattered light, and a particle velocity distribution or an electrophoretic mobility distribution of the particles is calculated.

[0004] FIG. 10 is a diagram illustrating an electroosmosis phenomenon inside a conventional sample cell container. An electroosmotic flow is a movement, due to the presence of ions, of the liquid that supports the particle dispersion. The ions are transported by the electric field. The distribution of the ions is influenced by charges present on the walls of the sample cell container.

[0005] The liquid flows in one direction at locations near the inner peripheral walls of the sample cell container and flows in the opposite returning direction at a central region of the sample cell container. This is called the electroosmotic flow U_{osm} .

[0006] "Up" in FIG. 10 represents the net flow of the particles dispersed and suspended in the liquid. There exist planes at each of which a peripheral flow (a flow near a cell wall that flows in one direction) of the electroosmotic flow U_{osm} and a central counterflow (a flow flowing in the opposite direction at a central portion side when viewed from a cross section of the cell) contact and mingle so that the velocity of the liquid becomes zero. These planes are called "stationary planes." In an electrophoretic mobility measurement method, it is considered preferable to attempt to perform a particle velocity distribution at the position of a stationary plane (see Patent Document 1).

[0007] In injecting a sample solution into a conventional electrophoretic mobility measurement cell, an electrode is set in an opening at one side of the cell and the opening is capped. The cell is then inverted and an appropriate amount of the sample solution is injected with a pipette, etc., from an opening at the other side while inclining the cell to avoid entry of bubbles. An electrode is then inserted in the opening at the other side and the opening is capped.

[0008] On the other hand, for samples mainly in bio-related fields and pharmaceutical-related fields, disposable cells,

which are discarded after measurement because of adsorption of sample and attachment of contaminants on the glass cell, are adopted.

PRIOR ART DOCUMENT(S)

[0009] Patent Document 1: Japanese Unexamined Patent Publication No. 2002-5888.

[0010] Patent Document 2: Japanese Unexamined Patent Publication No. Sho 52-145291.

SUMMARY OF THE INVENTION

[0011] Although an electrophoretic mobility measurement cell such as that described above must be sealed after injection so that the sample solution does not leak, bubbles form readily inside the cell in the process of sealing. If bubbles remain, errors arise in the measurement of the electrophoretic mobility and the ζ (zeta) potential.

[0012] Also, the cell and the electrodes are manufactured as separate parts and it takes to trouble to assemble these together. Moreover, the electrodes are removed and used repeatedly and the cell must thus be disassembled to recover the electrodes after the end of measurement.

[0013] Therefore an object of the present invention is to provide an electrophoretic mobility measurement cell, with which the cell and electrode portions are formed integrally, the electrode portions are made disposable together with the cell, and bubbles are unlikely to remain during injection of the sample solution, and provide a measurement apparatus and a measurement method using the cell.

[0014] An electrophoretic mobility measurement cell according to the present invention includes a container having a rectangular parallelepiped internal space for introducing a sample solution, at least two electrodes formed in the interior of the container and being for applying an electric field to the internal space, a tubular sample injection portion in communication with the internal space, a tubular sample extraction portion in communication with the internal space, a first cap for covering the sample injection portion and sealing the internal space, and a second cap for covering the sample extraction portion and sealing the internal space, the first cap has a first side surface contacting an inner side surface of the tubular sample injection portion when the first cap is mounted, the inner side surface of the tubular sample injection portion is formed so that the cross-sectional area of the tube increases with distance from the internal space, and the area of the cross section of the first side surface decreases gradually in the direction of insertion of the first cap.

[0015] With the present arrangement, as the first cap is pushed in, the sample solution that fills the internal space flows out from between the first side surface and the inner side surface of the sample injection portion, and formation of a pocket of air between the first cap and the water surface of the sample solution can thus be prevented. Mixing of bubbles into the sample solution is thus prevented and the formation of bubbles during sample injection can be suppressed.

[0016] The inner side surface of the tubular sample injection portion may form a fixed inclination angle with respect to a centerline of the tube in a sectional side view and the first side surface of the first cap may form the fixed inclination angle with respect to a centerline of the first cap in a sectional side view. In this case, as the first cap is pushed in, the sample solution filling the internal space flows out freely and