sized traps. Furthermore, bulk micromachining techniques, whereby holes are etched in a semiconductor body or wafer, provide traps with trap dimensions comparable to the wafer thickness (e.g., hundreds of microns). These relatively large traps are not well suited for truly field portable, handheld microanalytical systems. Such microanalytical systems, or "chemical laboratories on a chip," are being developed to enable the rapid and sensitive detection of particular chemicals, including pollutants, high explosives, and chemical warfare agents. These microanalytical systems should provide a high degree of chemical selectivity to discriminate against potential background interferents, be able to perform the chemical analysis on a short time scale, and consume low amounts of electrical power for prolonged field use.

[0013] Moreover, ion resolution and attenuation have become an issue with ion traps as they are miniaturized. Current cylindrical ion traps, due to their size constraints for optimal resolution (e.g., length approximately equal diameter), experience limited ion storage because of space charge effects.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] The present disclosure is best understood from the following detailed description when read with the accompanying figures. It is emphasized that, in accordance with the standard practice in the industry, various features are not drawn to scale. In fact, the dimensions of the various features may be arbitrarily increased or reduced for clarity of discussion.

[0015] FIG. **1** is a sectional view of at least a portion of apparatus according to one or more aspects of the present application.

[0016] FIG. **2**A is a top view of at least a portion of apparatus during an intermediate stage of manufacture according to one or more aspects of the present application.

[0017] FIG. **2**B is a top view of the apparatus shown in FIG. **2**A in a subsequent stage of manufacture according to one or more aspects of the present application.

[0018] FIG. **2**C is a top view of the apparatus shown in FIG. **2**B in a subsequent stage of manufacture according to one or more aspects of the present application.

[0019] FIG. **2**D is a top view of the apparatus shown in FIG. **2**C in a subsequent stage of manufacture according to one or more aspects of the present application.

[0020] FIG. **3** is a schematic view of at least a portion of a system according to one or more aspects of the present application.

[0021] FIG. **4** is a chart demonstrating the time/mass relationship for apparatus of the prior art and for apparatus according to one or more aspects of the present application.

[0022] FIG. **5** is a schematic view of at least a portion of apparatus according to one or more aspects of the present application.

[0023] FIG. **6** is a chart graphically depicting an operational example according to one or more aspects of the present application.

DETAILED DESCRIPTION

[0024] It is to be understood that the following disclosure provides many different embodiments, or examples, for implementing different features of various embodiments. Specific examples of components and arrangements are described below to simplify the present disclosure. These are, of course, merely examples and are not intended to be limiting. In addition, the present disclosure may repeat reference numerals and/or letters in the various examples. This repetition is for the purpose of simplicity and clarity and does not in itself dictate a relationship between the various embodiments and/or configurations discussed. Moreover, the formation of a first feature over or on a second feature in the description that follows may include embodiments in which the first and second features are formed in direct contact, and may also include embodiments in which additional features may be formed interposing the first and second features, such that the first and second features may not be in direct contact.

[0025] Referring to FIG. **1**, illustrated is a sectional view of at least a portion of apparatus **100** according to one or more aspects of the present application. The apparatus **100** may be, or be included in, a coaxial ring ion trap.

[0026] The apparatus **100** includes a plurality of ring electrode segments **110** each having a substantially cylindrical annulus shape. Each segment **110** may have an internal diameter D ranging between about 100 μm and about 1 cm. For example, each segment **110** may have an internal diameter D of about 1 mm. Each segment **110** may also have a thickness T ranging between about 1 μm and about 100 μm, such as a thickness T of about 50 μm. The internal diameter D of each of the segments **110**, and/or the thickness T of each of the segments **110**, is not necessarily the same. For example, the diameter D of centrally located ones of the segments **110** may be slightly or substantially larger than the diameter D of opposing ones of the segments **110**.

[0027] The apparatus **100** may also include a plurality of insulators **120** each interposing neighboring ones of the ring segments **110**. Each insulator **120** may have an internal diameter substantially equal to the diameter D of neighboring ones of the segments **110**, and may be coaxially aligned with neighboring ones of the segments **110**. The insulators **120** may each be formed directly on a neighboring one of the segments **110**, such as on an immediately previously formed segment **110**. However, the apparatus **100** may also include additional layers interposing neighboring ones of the segments **110** and insulators **120**. For example, such additional layers may comprise one or more adhesive layers, etch stop layers, and/or implant barrier layers, among others.

[0028] The apparatus **100** may also include one or more endcaps. For example, in the embodiment depicted in FIG. **1**, the apparatus **100** includes an injection endcap **130** and an extraction endcap **140**. The endcap **130** includes an aperture **135** through which ions are injected into the apparatus **100**, and the endcap **140** includes an aperture **145** through which ions are extracted or expelled from the apparatus **100**. The apertures **135**, **145** may each have a diameter ranging between about 10 μm and about 2.5 mm. For example, the apertures **135**, **145** may each have a diameter of about 250 μm. However, other diameters of the apertures **135**, **145** are also within the scope of the present application.

[0029] The endcaps **130**, **140** may comprise doped silicon, stainless steel, aluminum, copper, nickel plated silicon or other nickel plated materials, gold, and/or other electrically conductive materials, and may be formed by laser etching, Liga, reactive ion etching (RIE) and other types of etching, micromachining, and/or other manufacturing processes.