CLAIMS

1. A radio frequency ion guide, comprising:
   a plurality of electrodes, each of the electrodes having at least one row of elements protruding from a holder, each of the protruding elements, at a distal end, having an electrically conductive aperture contour forming portion; and
   a mechanism for assembling the electrodes so that rows of protruding elements cooperate to form a row of substantially plane segmented aperture members, each of the segmented aperture members having a plurality of insulating gaps located between cooperating protruding elements, and a central aperture defined by cooperating aperture contour forming portions.

2. The ion guide according to claim 1, wherein, in each of the plurality of electrodes, a dimension of the aperture contour forming portion changes from element to element along the at least one row of protruding elements, so that, when the rows of protruding elements of the plurality of electrodes cooperate, a dimension of the central aperture generally decreases along the row of segmented aperture members.

3. The ion guide according to any one of claims 1 or 2, wherein each electrode at one end comprises an attachment plate, via which the each electrode is coupled to a support plate.

4. The ion guide according to any one of claims 1 to 3, wherein in each of the plurality of electrodes the holder comprises a plurality of pumping apertures there-through.

5. The ion guide according to any one of claims 1 to 4, wherein each row of protruding elements comprises a first protruding element, a last protruding element, and a group of intermediate protruding elements, and wherein in each of the plurality of electrodes the holder and at least the group of intermediate protruding elements are machined integrally from a single piece of conductive material.

6. The ion guide according to claim 5, wherein the first protruding element and the last protruding element are mechanically attached to, and electrically insulated from, the holder and supplied with radio frequency and direct current potentials separate from radio frequency and direct current potentials applied to other protruding elements.

7. The ion guide according to any one of claims 1 to 6, wherein, in each of the plurality of electrodes, the plurality of protruding elements are arranged in two parallel rows on the holder, wherein one row is shifted spatially in an axial direction, such that the protruding elements in one row are located across a space between two protruding elements in the other row.

8. The ion guide according to claim 7, wherein the protruding elements in one row are centred across the space between two protruding elements in the other row.

9. The ion guide according to any one of claims 1 to 8, wherein the protruding elements of each segmented aperture member cooperate to form opposing pairs, the opposing pairs being configured to receive different phases of a radio frequency potential.

10. The ion guide according to any one of claims 1 to 9, wherein the protruding elements of the segmented aperture members are substantially aligned along a common axis along the row, each protruding element in one segmented aperture member receiving a different phase of radio frequency potential than the protruding elements in adjacent segmented aperture members aligned therewith.

11. The ion guide according to any one of claims 1 to 10, wherein all electrodes are identical and assembled around a common longitudinal axis with rotational symmetry.

12. An apparatus for performing mass spectrometry comprising:
an ion source;
a mass analyser; and
an ion guide according to any one of the claims 1 to 11, the ion guide having an inlet end coupled to the ion source and an outlet end coupled to the mass analyser, and being configured for guiding ions from the ion source to the mass analyser, wherein the ion source is maintained at a pressure higher than the mass analyser.

13. An electrode for a radio frequency ion guide, comprising:
a holder; and
a plurality of protruding elements extending in at least two adjacent rows from the holder, each of the rows having a first protruding element, a last protruding element, and a group of intermediate protruding elements and each of the protruding elements, at a distal end, has an electrically conductive aperture contour forming portion, and wherein the holder and at least the group of intermediate protruding elements are machined integrally from a single piece of conductive material.

14. The electrode of claim 13, wherein, in each row, the first protruding element, the last protruding element, and the group of intermediate protruding elements together with the holder are machined integrally from a single piece of conductive material.

15. The electrode of claim 13, wherein the first protruding element and the last protruding element are mechanically attached to, but electrically insulated from, the holder.

16. The electrode of any one of claims 13 to 15, wherein the protruding elements have the shape of fins, and the aperture contour forming portion is a recessed outer contour portion at a distal end of the fins.

17. The electrode of any one of claims 13 to 16, wherein the holder is a back plate.

18. The electrode of claim 17, wherein the back plate comprises a plurality of pumping apertures.

19. The electrode of any one of claims 13 to 18, wherein the plurality of protruding elements is surface treated to provide chemical resistance.

CLAIMS

1. A radio frequency ion guide, comprising:

a plurality of electrodes, each of the electrodes having at least one row of elements protruding from a holder, each of the protruding elements, at a distal end, having an electrically conductive aperture contour forming portion;

a mechanism for assembling the electrodes so that rows of protruding elements cooperate to form a row of substantially plane segmented aperture members, each of the segmented aperture members having a plurality of insulating gaps located between cooperating protruding elements, and a central aperture defined by cooperating aperture contour forming portions.

2. The ion guide according to claim 1, wherein, in each of the plurality of electrodes, a dimension of the aperture contour forming portion changes from element to element along the at least one row of protruding elements, so that when the rows of protruding elements of the plurality of electrodes cooperate, a dimension of the central aperture generally decreases along the row of segmented aperture members.

3. The ion guide according to claim 1, wherein each electrode at one end comprises an attachment plate, via which the each electrode is coupled to a support plate.

4. The ion guide according to claim 1, wherein in each of the plurality of electrodes the holder comprises a plurality of pumping apertures therethrough.

5. The ion guide according to claim 1, wherein each row of protruding elements comprises a first protruding element, a last protruding element, and a group of intermediate protruding elements, and wherein in each of the plurality of electrodes the holder and at least the group of intermediate protruding elements are machined integrally from a single piece of conductive material.

6. The ion guide according to claim 5, wherein the first protruding element and the last protruding element are mechanically attached to, and electrically insulated from, the

holder and supplied with radio frequency and direct current potentials separate from radio frequency and direct current potentials applied to other protruding elements.

7. The ion guide according to claim 1, wherein, in each of the plurality of electrodes, the plurality of protruding elements are arranged in two parallel rows on the holder, wherein one row is shifted spatially in an axial direction, such that the protruding elements in one row are located across a space between two protruding elements in the other row.

8. The ion guide according to claim 7, wherein the protruding elements in one row are centered across the space between two protruding elements in the other row.

9. The ion guide according to claim 1, wherein the protruding elements of each segmented aperture member cooperate to form opposing pairs, the opposing pairs being configured to receive different phases of a radio frequency potential.

10. The ion guide according to claim 1, wherein the protruding elements of the segmented aperture members are substantially aligned along a common axis along the row, each protruding element in one segmented aperture member receiving a different phase of radio frequency potential than the protruding elements in adjacent segmented aperture members aligned therewith.

11. The ion guide according to claim 1, wherein all electrodes are identical and assembled around a common longitudinal axis with rotational symmetry.

12. An apparatus for performing mass spectrometry comprising:

an ion source;

a mass analyzer; and

an ion guide having a plurality of electrodes, each of the electrodes having at least one row of elements protruding from a holder, each of the protruding elements, at a distal end, having an electrically conductive aperture contour forming portion and a mechanism for assembling the electrodes so that rows of protruding elements cooperate to form a row of substantially plane segmented aperture members, each of the segmented aperture members having a plurality of insulating gaps located between cooperating protruding

elements, and a central aperture defined by cooperating aperture contour forming portions, the ion guide having an inlet end coupled to the ion source and an outlet end coupled to the mass analyzer, and being configured for guiding ions from the ion source to the mass analyzer, wherein the ion source is maintained at a pressure higher than the mass analyzer.

13. An electrode for a radio frequency ion guide, comprising:

a holder;

a plurality of protruding elements extending in at least two adjacent rows from the holder, each of the rows having a first protruding element, a last protruding element, and a group of intermediate protruding elements and each of the protruding elements, at a distal end, has an electrically conductive aperture contour forming portion, and wherein the holder and at least the group of intermediate protruding elements are machined integrally from a single piece of conductive material.

14. The electrode of claim 13, wherein, in each row, the first protruding element, the last protruding element, and the group of intermediate protruding elements together with the holder are machined integrally from a single piece of conductive material.

15. The electrode of claim 13, wherein the first protruding element and the last protruding element are mechanically attached to, but electrically insulated from, the holder.

16. The electrode of claim 13, wherein the protruding elements have the shape of fins, and the aperture contour forming portion is a recessed outer contour portion at a distal end of the fins.

17. The electrode of claim 13, wherein the holder is a back plate.

18. The electrode of claim 17, wherein the back plate comprises a plurality of pumping apertures.

19. The electrode of claim 13, wherein the plurality of protruding elements is surface treated to provide chemical resistance.