CLAIMS

1. A device comprising:

a first surface configured to receive ions, the first surface comprising:

a first plurality of electrodes comprising a first electrode and a second electrode, the first plurality of electrodes extending along a first direction, in which the first electrode is configured to receive a first radio frequency (RF) voltage signal and the second electrode is configured to receive a second RF voltage signal, in which the first electrode is spaced apart from the second electrode along a second direction lateral to the first direction;

a second plurality of electrodes located between the first electrode and the second electrode and arranged along the first direction, in which the second plurality of electrodes are configured receive a first alternating current (AC) voltage waveform and to generate a first traveling wave along the first direction in response to receipt of the first AC voltage waveform,

in which the first traveling wave is configured to guide the received ions along the first direction.

2. A device according to Claim 1, in which the first RF voltage signal and the second RF voltage signal are phase shifted by 180 degrees.

3. A device according to Claim 1, in which the first and the second electrodes are configured to generate a pseudopotential that inhibits the received ions from approaching the first surface.

4. A device according to Claim 1, in which the first surface is curved and the first plurality of electrodes and the second plurality of electrodes conform to a curvature of the first surface.

5. A device according to Claim 1, further comprising a plurality of guard electrodes positioned adjacent to outermost electrodes of the first and the second plurality of electrodes along the second direction, in which the plurality of guard electrodes are configured to receive a direct current (DC) voltage and to generate a guard electric field configured to constrains ion motion along the second direction.

6. A device according to Claim 1, in which the first AC voltage waveform is a sinusoidal wave or a superposition of two or more sinusoidal waves.

7. A device according to Claim 1, in which the first surface further comprises:

a third plurality of electrodes comprising a third electrode and a fourth electrode, the third plurality of electrodes extending a long a third direction, in which the third electrode is configured to receive a third RF voltage signal and the fourth electrode is configured to receive a fourth RF voltage signal, in which the third electrode is spaced apart from the fourth electrode along a fourth direction lateral to the third direction;

a fourth plurality of electrodes located between the third electrode and the fourth electrode and arranged along the third direction, in which the fourth plurality of electrodes are configured receive a second AC voltage waveform and generate a second traveling wave along the third direction in response to receipt of the second AC voltage waveform,

in which the second traveling wave is configured to guide the received ions along the third direction.

8. A device according to Claim 7, in which the third direction is the first direction and the fourth direction is the second direction.

9. A method comprising:

providing a first surface comprising:

a first plurality of electrodes comprising a first electrode and a second electrode, the first plurality of electrodes extending along a first direction, in which the first electrode is spaced apart from the second electrode along a second direction lateral to the first direction, and

a second plurality of electrodes located between the first electrode and the second electrode and arranged along the first direction;

providing ions along the first surface;

applying a first radio frequency (RF) voltage signal to the first electrode and a second RF voltage signal to the second electrode;

applying a first AC voltage waveform to the second plurality of electrodes, in which the second plurality of electrodes is configured to generate a first traveling wave along the first direction in response to the application of the first AC voltage waveform,

in which the first traveling wave is configured to guide the ions along the first direction.

10. A method according to Claim 9, in which the first RF voltage signal and the second RF voltage signal are phase shifted by 180 degrees.

11. A method according to Claim 9, in which the first and the second electrodes are configured to generate a pseudopotential that inhibits the received ions from approaching the first surface.

12. A method according to Claim 9, further comprising:

applying direct current (DC) voltage to a plurality of guard electrodes, the first surface includes the plurality of guard electrodes that are positioned adjacent to outermost electrodes of the first and the second plurality of electrodes along the second direction,

in which the plurality of guard electrodes are configured to generate a guard electric field in response to the application of the DC voltage, the guard electric field configured to constrain ion motion along the second direction.

13. A method according to Claim 9, in which the first AC voltage waveform is a sinusoidal wave or a superposition of two or more sinusoidal waves.

14. A method according to Claim 9, in which the first surface is curved and the first plurality of electrodes and the second plurality of electrodes conform to a curvature of the first surface.

15. A method according to Claim 9, in which the first surface further includes:

a third plurality of electrodes comprising a third electrode and a fourth electrode, the third plurality of electrodes extending along a third direction, in which the third electrode is spaced apart from the fourth electrode along a fourth direction lateral to the third direction; and

a fourth plurality of electrodes located between the third electrode and the fourth electrode and arranged along the third direction.

16. A method according to Claim 15, further comprising applying a third RF voltage signal to the third electrode and applying a fourth RF voltage signal to the fourth electrode.

17. A method according to Claim 15, further comprising applying one of the first RF voltage signal and the second RF voltage signal to the third electrode.

18. A method according to Claim 15, further comprising applying a second AC voltage waveform to the fourth plurality of electrodes configured to generate a second traveling wave along the third direction, in which the second traveling wave is configured to guide the ions along the third direction.