CLAIMS

1. An electrosurgical instrument comprising:

a coaxial feed cable for conveying microwave energy and radiofrequency energy, the coaxial feed cable having an inner conductor, an outer conductor, and a first dielectric material separating the inner conductor and the outer conductor; and

a radiating tip portion disposed at a distal end of the coaxial cable to receive the microwave energy and the radiofrequency energy, the radiating tip portion comprising:

a tip body made of a second dielectric material, the tip body having a proximal end that is connected to a distal end of the coaxial feed cable and a distal end facing away from the coaxial feed cable, wherein the tip body includes an end face at the distal end of the tip body; and

a first electrode and a second electrode disposed on the end face of the tip body, the second electrode being spaced from the first electrode by a portion of exposed second dielectric material,

wherein the first electrode is electrically connected to the inner conductor of the coaxial feed cable by a conductive element that extends through a channel in the tip body,

wherein the second electrode is electrically connected to the outer conductor of the coaxial cable by a field-shaping conductive structure formed in or on the tip body,

wherein the first electrode and second electrode are configured as active and return electrodes for delivering the radiofrequency energy,

wherein the conductive element and the field-shaping conductive structure are configured as an antenna for emitting the microwave energy, and

wherein the field-shaping conductive structure is configured to shape a radiation profile of microwave energy emitted from the radiating tip portion.

2. An electrosurgical instrument according to claim 1, wherein the field-shaping conductive structure includes an elongate conductor extending along a length of the radiating tip portion.

3. An electrosurgical instrument according to claim 1, wherein the field-shaping conductive structure includes a slotted conductive structure formed around the conductive element.

4. An electrosurgical instrument according to claim 3, wherein the slotted conductive structure comprises a helical conductive element wound around the outer surface of the tip body to form a helical slot in which the second dielectric material is exposed.

5. An electrosurgical instrument according to claim 4, wherein a pitch of the helical slot varies along a length of the conductive structure.

6. An electrosurgical instrument according to claim 4 or 5, wherein a width of the helical slot tapers as it extends towards or away from the distal end of the tip body.

7. An electrosurgical instrument according to any one of claims 3 to 5, wherein the slotted conductive structure comprises a slot having a width that is around a tenth of a wavelength of the microwave energy in the biological tissue.

8. An electrosurgical instrument according to claim 3, wherein the slotted conductive structure includes a plurality of slots for emitting the microwave energy.

9. An electrosurgical instrument according to claim 8, wherein each of the plurality of slots has an identical width, and the slots are evenly spaced along a longitudinal direction of the radiating tip portion.

10. An electrosurgical instrument according to claim 8, wherein each of the plurality of slots has a different width, and wherein the plurality of slots are arranged along a longitudinal direction of the radiating tip portion in order of increasing width.

11. An electrosurgical instrument according to any previous claim, wherein the conductive element comprises a

distal portion of inner conductor that protrudes through the tip body to connect to the first electrode.

12. An electrosurgical instrument according to claim 11, wherein the first electrode is an exposed distal tip of the distal portion of the inner conductor.

13. An electrosurgical instrument according to any one of claims 3 to 12, wherein the slotted conductive structure is formed on an outer surface of the tip body.

14. An electrosurgical instrument according to any one of claims 3 to 13, wherein the slotted conductive structure is formed by an extension of the outer conductor over the tip body.

15. An electrosurgical instrument according to any one of claims 3 to 13, wherein the slotted conductive structure is electrically connected to the outer conductor by a conductive ring disposed at the distal end of the coaxial feed cable.

16. An electrosurgical instrument according to any previous claim, wherein the tip body is cylindrical.

17. An electrosurgical instrument according to any previous claim, wherein the end face of the tip body lies in a plane that is normal to a longitudinal axis of the coaxial feed cable.

18. An electrosurgical instrument according to any one of claims 1 to 16, wherein the end face of the tip body is dome-shaped or conical.

19. An electrosurgical instrument according to any previous claim, wherein the second electrode is a conductive ring that surrounds the first electrode.

20. An electrosurgical instrument according to claim 19, wherein an outer diameter of the second electrode is substantially the same as an outer diameter of the tip body.

21. An electrosurgical instrument according to any preceding claim, wherein the second electrode comprises a conductive cap mounted over the distal end of the tip body, and wherein the cap covers the end face of the tip body except for an exposed aperture within which the first electrode is revealed.

22. An electrosurgical system comprising:

an electrosurgical generator arranged to supply microwave energy and radiofrequency energy; and

an electrosurgical instrument according to any preceding claim connected to receive the microwave energy and radiofrequency energy from the electrosurgical generator.

23. An electrosurgical system according to claim 22 further comprising a surgical scoping device having a flexible insertion cord for insertion into a patient’s body, wherein the flexible insertion cord has an instrument channel running along its length, and wherein the electrosurgical instrument is dimensioned to fit within the instrument channel.