

Patent Claims

1. A large area microwave plasma chemical vapour deposition, LA MPCVD, reactor apparatus, comprising;
 - a reactor chamber adapted to provide a plasma region in an interior of the reactor chamber by electromagnetic energy at a first frequency, and
 - a Composite Right/Left-Handed, CRLH, waveguide section adapted to operate with an infinite wavelength at the first frequency and having in a wall a coupler means arranged to couple electromagnetic energy from an interior of the CRLH waveguide section to the interior of the reactor chamber.
2. The LA MPCVD reactor apparatus of claim 1, wherein the coupler means comprises a plurality of electromagnetic energy couplers spaced with respect to each other.
3. The LA MPCVD reactor apparatus of claim 1 or 2, wherein the coupler means comprises a slot in the wall of the CRLH waveguide section.
4. The LA MPCVD reactor apparatus of claim 1, 2 or 3, comprising a source of electromagnetic energy having an energy output, and wherein one or more CRLH waveguides in the CRLH waveguide section has a first energy input end coupled to the energy output.
5. The LA MPCVD reactor apparatus of claim 4, wherein one or more CRLH waveguides in the CRLH waveguide section has a second, shorted end.
6. The LA MPCVD reactor apparatus of any of the previous claims, wherein the reactor chamber comprises a first and a second sub chamber, wherein the first sub chamber comprises the coupler means, and the second sub-chamber is adapted to comprise the plasma region, and wherein the electromagnetic energy is provided from the CRLH waveguide section to the second sub-chamber via the first sub-chamber.
7. The LA MPCVD reactor apparatus of claim 6, wherein the first and second sub-chambers in a cross section have the same area.
8. The LA MPCVD reactor apparatus of claim 6 or 7, wherein the second sub-chamber comprises quartz windows arranged to separate the plasma region from atmospheric pressure.

9. The LA MPCVD reactor apparatus of any of the claims 6 to 8 above, wherein the first and second sub-chambers are arranged on top of each other and interconnected in each end.
10. The LA MPCVD reactor apparatus of any of the previous claims, wherein the electromagnetic energy is microwave energy at the first frequency.
11. The LA MPCVD reactor apparatus of any of the previous claims, wherein the first frequency is 2.45GHz.
12. The LA MPCVD reactor apparatus of any of the previous claims, wherein the CRLH waveguide section comprises a plurality of CRLH waveguides arranged side-by-side.
13. The LA MPCVD reactor apparatus of any of the claims above, wherein the CRLH waveguide section comprises periodically cascaded unit cells, wherein the unit cells a relationship between frequency and phase shift is configurable.
14. The LA MPCVD reactor apparatus of claim 13, wherein the unit cells comprises tuning elements configured to modify internal dimensions of the unit cells.
15. The LA MPCVD reactor apparatus of claim 14, wherein the tuning elements comprises a pair of stubs arranged to be inserted into the unit cells.
16. A method for providing a large area plasma chemical vapour deposition in a reactor chamber wherein the reactor chamber is arranged to provide a plasma region in an interior of the reactor chamber by electromagnetic energy at a first frequency, wherein the method comprises;
coupling electromagnetic energy from an interior of a Composite Right/Left-Handed, CRLH, waveguide section to the interior of the reactor chamber via a wall coupler means of the CRLH section, wherein the CRLH waveguide section is arranged to operate with an infinite wavelength at the first frequency.
17. The method of claim 16, wherein the a CRLH waveguide section comprises periodically cascaded unit cells comprising tuning elements configured to modify internal dimensions of the unit cells, wherein the method comprises
adjusting the tuning elements.

18. The method of claim 17, wherein a source of electromagnetic energy having an energy output is connected to an input of the CRLH waveguide section, wherein the method comprises

minimizing a measured reflected power by iteratively adjusting the tuning elements and impedance matching the source with the CRLH waveguide section.