Abstract: Embodiments of the invention provide a method and apparatus, such as a processing chamber, suitable for etching high aspect ratio features. Other embodiments include a showerhead assembly (130) for use in the processing chamber (100). In one embodiment, a processing chamber (100) includes a chamber body (102) having a showerhead assembly (130) and substrate support (148) disposed therein. The showerhead assembly (130) includes at least two fluidly isolated plenums, a region transmissive to an optical metrology (140) signal, and a plurality of gas passages (242) formed through the showerhead assembly fluidly coupling the plenums to the interior volume of the chamber body.

FIG. 1
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123. The showerhead assembly of claim 116 further comprising:
   concentric rings of adhesive coupling the gas distribution plate to the
   upper section, wherein the concentric rings form radially isolated concentric
   plenums defined between gas distribution plate and the upper section.

124. The showerhead assembly of claim 123 further comprising:
   beads of adhesive disposed between concentric rings of adhesive,
   wherein gases present between the gas distribution plate, the upper section
   and a pair of adhesive rings may flow around the beads.

125. The showerhead assembly of claim 116, wherein the upper section
   further comprises:
      a base having a stepped recess;
      a first plate disposed in the recess;
      a second plate disposed in the recess between the first place and the
      base; and
      a barrier wall disposed between the first and second plates and
      separating the first and second plenums.

126. The showerhead assembly of claim 125, wherein the upper section
   further comprises:
      a plurality of pins spacing the first plate from the second plate.

127. The showerhead assembly of claim 126, wherein the pins are press fit
   into the first and second plates.

128. The showerhead assembly of claim 126, wherein the first plate
   comprises a plurality of gas passages, wherein each gas passage further
   comprises:
      an orifice hole disposed between a first bore hole and a second bore
      hole, wherein bore holes have substantially greater diameter and depth
      relative to the orifice hole.
129. A showerhead assembly, comprising:
   an upper section having a plurality of gas flow passages separating an upper plenum from a lower plenum;
   a gas distribution plate coupled to the upper section and having a plurality of gas flow holes fluidly coupled to the lower plenum; and
   an optically transmissive passage defined though the upper section and the gas distribution plate.

130. The showerhead assembly of claim 129, wherein the optically transmissive passage further comprises:
   a sealed window; and
   a member disposed between the window and the gas distribution plate;
   and
   a plurality of high aspect ratio holes formed in the member.

131. The showerhead assembly of claim 129, wherein the high aspect ratio holes have an aspect ratio (height to diameter) of at least about 10:1.

132. The showerhead assembly of claim 129, wherein the high aspect ratio holes have a diameter of less than or comparable at least one of a DEBYE length and/or the electron mean free path.

133. The showerhead assembly of claim 129, wherein the high aspect ratio holes have a diameter less than about 1.5 mm,

134. The showerhead assembly of claim 129, wherein the high aspect ratio holes define an open area of up to about 60 percent open area.

135. The showerhead assembly of claim 129, wherein the high aspect ratio holes have 37 holes.
136. The showerhead assembly of claim 129, wherein the member further comprises ceramic.

137. The showerhead assembly of claim 129, wherein the upper section further comprises:
   a base having a stepped recess;
   a first plate disposed in the recess;
   a second plate disposed in the recess between the first place and the base; and
   a barrier wall disposed between the first and second plates and separating the first and second plenums.

138. The showerhead assembly of claim 137, wherein the upper section further comprises:
   a plurality of pins spacing the first plate from the second plate.

139. The showerhead assembly of claim 137, wherein the pins are press fit into the first and second plates.

140. The showerhead assembly of claim 137, wherein the first plate comprises a plurality of gas passages, wherein each gas passage further comprises:
   an orifice hole disposed between a first bore hole and a second bore hole, wherein bore holes have substantially greater diameter and depth relative to the orifice hole.

141. The showerhead assembly of claim 129, wherein the gas distribution plate is fabricated from bulk Yttria.

142. The showerhead assembly of claim 129, wherein the optically transmissive region further comprises a plurality of high aspect ratio holes.
143. The showerhead assembly of claim 129 further comprising:
concentric rings of adhesive coupling the gas distribution plate to the
upper section, wherein the concentric rings form radially isolated concentric
plenums defined between gas distribution plate and the upper section.

144. The showerhead assembly of claim 143 further comprising:
beads of adhesive disposed between concentric rings of adhesive,
wherein gases present between the gas distribution plate, the upper section
and a pair of adhesive rings may flow around the beads,

145. A showerhead assembly, comprising:
a base having a stepped recess;
a first plate disposed in the recess;
a second plate disposed in the recess between the first place and the base;
a ceramic plug having a plurality a high aspect ratio holes formed therethrough, the high aspect ratio holes have a diameter less than about 1.5
mm and an aspect ratio (height to diameter) of at least about 10:1;
a barrier wall disposed between the first and second plates and
separating a first and second plenums defined the first and second plates;
a gas distribution plate coupled to the first plate by a plurality of
concentric adhesive lines and having a plurality of gas flow holes aligned
between adhesive lines; and
an optically transmissive passage defined though the base, plates, and
ceramic plug and the gas distribution plate.