SHOWERHEAD ELECTRODES AND SHOWERHEAD ELECTRODE ASSEMBLIES HAVING LOW-PARTICLE PERFORMANCE FOR SEMICONDUCTOR MATERIAL PROCESSING APPARATUSES

ABSTRACT

Showerhead electrode (24) for a semiconductor material processing apparatus is disclosed. An embodiment of the showerhead electrodes (24) includes top and bottom electrodes (21, 42) bonded to each other. The top electrode (21) includes one or more plenums (56, 58, 60). The bottom electrode (42) includes a plasma-exposed bottom surface and a plurality of gas holes in fluid communication with the plenum. Showerhead electrode assembly including a showerhead electrode flexibly suspended from a top plate is also disclosed. The showerhead electrode assembly can be in fluid communication with temperature-control elements spatially separated from the showerhead electrode to control the showerhead electrode temperature. Methods of processing substrates in a plasma processing chamber including the showerhead electrode assembly and a plasma processing chamber are also disclosed.

Figure 1