

MICROWAVE PLASMA REACTORS AND SUBSTRATES FOR SYNTHETIC

DIAMOND MANUFACTURE

ABSTRACT

A microwave plasma reactor for manufacturing synthetic diamond material via chemical vapour deposition, the microwave plasma reactor comprising: a microwave generator configured to generate microwaves at a frequency f ; a plasma chamber comprising a base, a top plate, and a side wall extending from said base to said top plate defining a resonance cavity for supporting a microwave resonance mode between the base and the top plate; a microwave coupling configuration for feeding microwaves from the microwave generator into the plasma chamber; a gas flow system for feeding process gases into the plasma chamber and removing them therefrom; a substrate holder disposed in the plasma chamber and comprising a supporting surface for supporting a substrate; and a substrate disposed on the supporting surface, the substrate having a growth surface on which the synthetic diamond material is to be deposited in use, wherein the substrate dimensions and location within the resonance cavity are selected to generate a localized axisymmetric E_z electric field profile across the growth surface in use, the localized axisymmetric E_z electric field profile comprising a substantially flat central portion bound by a ring of higher electric field, the substantially flat central portion extending over at least 60% of an area of the growth surface of the substrate and having an E_z electric field variation of no more than $\pm 10\%$ of a central E_z electric field strength, the ring of higher electric field being disposed around the central portion and having a peak E_z electric field strength in a range 10% to 50% higher than the central E_z electric field strength.

Figure 1