Simulation and development of a new microwave plasma chemical vapor deposition reactor for diamond films deposition

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While microwave plasma chemical vapor deposition (MPCVD) technique is advantageous in depositing high quality diamond films, low deposition rate remains the primary concern of the technique. On the other hand, it has been known that by increasing the input power into a MPCVD reactor, deposition rate of diamond films could be increased. Therefore, there has been a continuous search for new efficient high power MPCVD reactors [1].

In this article, a new MPCVD reactor which could be operated at high input powers will be presented. In Fig.1, a schematic of the reactor and distribution of microwave electric field in the reactor, obtained by numerical simulation, are shown. It could be seen from the figure that the reactor is mainly composed of a cylindrical cavity, with TM_{021} as its primary resonance mode.

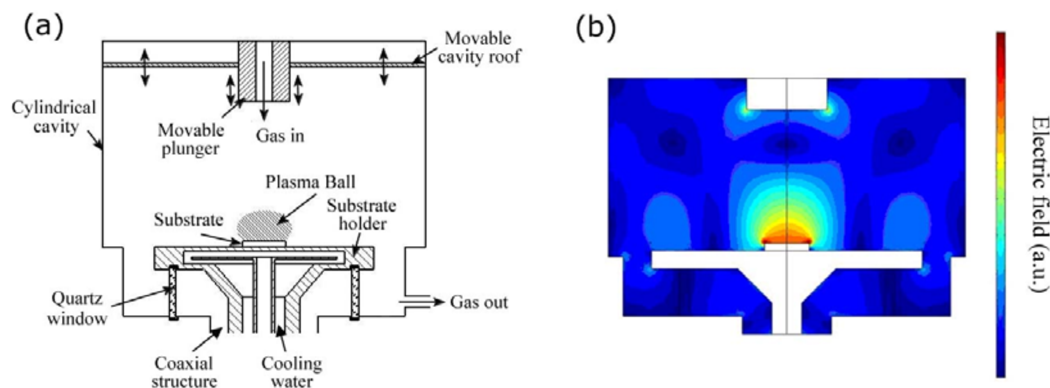

Fig.1 (a) A schematic of the new MPCVD reactor and (b) simulated distribution of microwave electric field inside the reactor

To optimize the design of the reactor, hydrogen plasma inside the reactor has been simulated by using a discharge model suggested by Fuenner *et al*. [2]. It will be shown that using the newly developed reactor, high quality diamond films could be deposited at high input microwave power levels, and the capability to deposit diamond films at high deposition rate will be demonstrated.

References

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