## Microwave plasma-assisted chemical vapor deposition of microcrystalline diamond films via graphite etching under different hydrogen flow rates

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**Figure. S1** Diamond grain size distribution (column) and percentage of all particles with size below the given one (red line) characterized by laser grain size analyzer

The result of diamond particles in the suspension obtained by laser grain size analyzer is shown below. It can be seen that the diamond grain size is mainly concentrated between 30 and 40 nm, which agrees with the statement in the manuscript.



Fig. S2 XRD pattern for a polycrystalline graphite plate



Fig. S3 SEM image of the virgin graphite surface



Fig. S4 Raman spectroscopy of the virgin graphite

The graphite plates used here are polycrystalline, with a strong crystal orientation of (002), and much weaker (100), (101), (004), (110), (112) planes, which are characterized by X-ray diffraction (XRD), as shown in Fig. S2 of this comment. In addition, it can be seen from the scanning electron microscopy (SEM) image (Fig. S3, this comment) that the surface of the virgin graphite plate is rough and has some holes. Raman spectroscopy of the virgin graphite is also obtained. There are three graphite peaks: D band (1350 cm<sup>-1</sup>), G band (1580 cm<sup>-1</sup>) and G' band (2700 cm<sup>-1</sup>) dominate the spectrum. The G band is related to phonon vibrations in sp<sup>2</sup> carbon materials, while the D band is ascribed to disordered carbon, edge defects, and other defects. The high frequency shoulder of the G peak at 1620 cm<sup>-1</sup> is the D' peak, which is the defect indicated by the Raman feature as well as the D peak, and thus these bands cannot be seen for a highly ordered graphite. The Raman feature at about 2950 cm<sup>-1</sup> is associated with a D + G combination mode and also is induced by disorder. The strong peak and minor peak at ~2400 cm<sup>-1</sup> are associated with the 2<sup>nd</sup> order spectrum of graphite, the G' frequency being almost doubled to that of D peak, as exhibited in Fig. S4.

H <sub>2</sub> flow rate, sccm	Graphite peak area	Diamond peak area	C-O-C peak area	Fitted spectrum area	Measured spectra area	Graphite/ diamond ratio,%	Difference in area between fit and measured spectrum,%
25	223	15951	2316	18490	17932	1.40	3.1
50	201	18430	2142	20773	21454	1.09	3.2
100	130	20550	3330	24010	23303	0.63	3.0
200	110	26028	3153	29291	28461	0.42	2.9

**Table.** S1 The peak area and graphite/diamond ratio in XPS spectra. The area under peak (spectrum) is given in arb.unites