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Controllable Growth of Vertically-oriented Graphene for High Sensitivity Gas Detection

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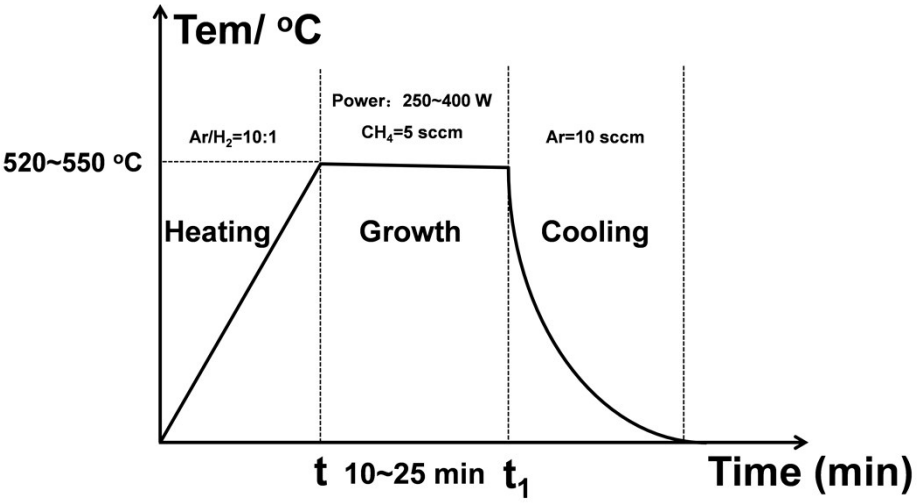

Fig. S1 Experimental process schematic illustrates the preparation of VGNPs by PACVD

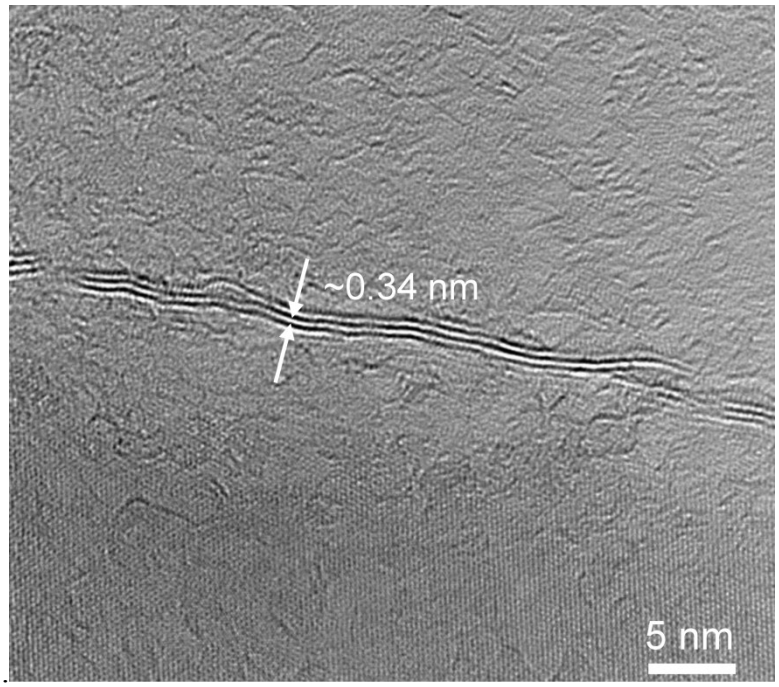

Fig. S2 HR-TEM of the VGNPs.

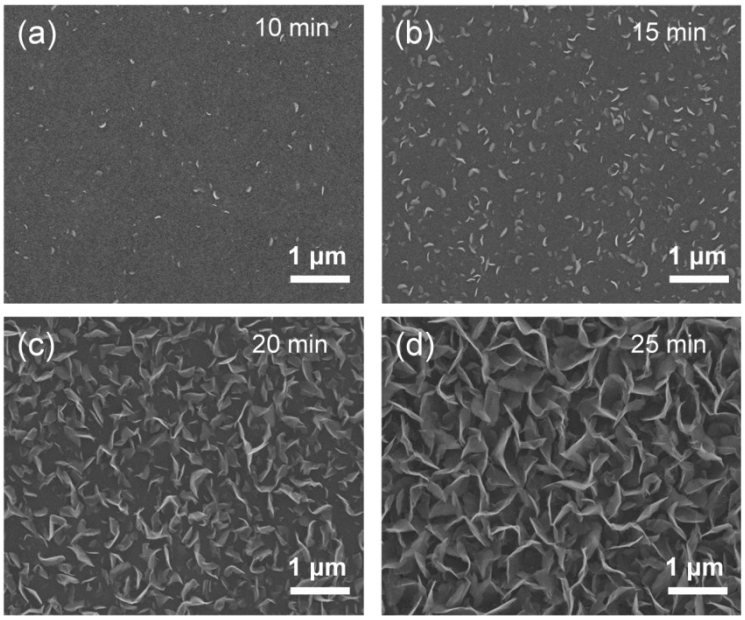

Fig. S3 SEM images of VGNPs directly grown on SiO_2 substrates for growth time of 10 min, 15 min, 20 min and 25 min, respectively, with I_{RF} of 400 W at 550 ^{o}C.

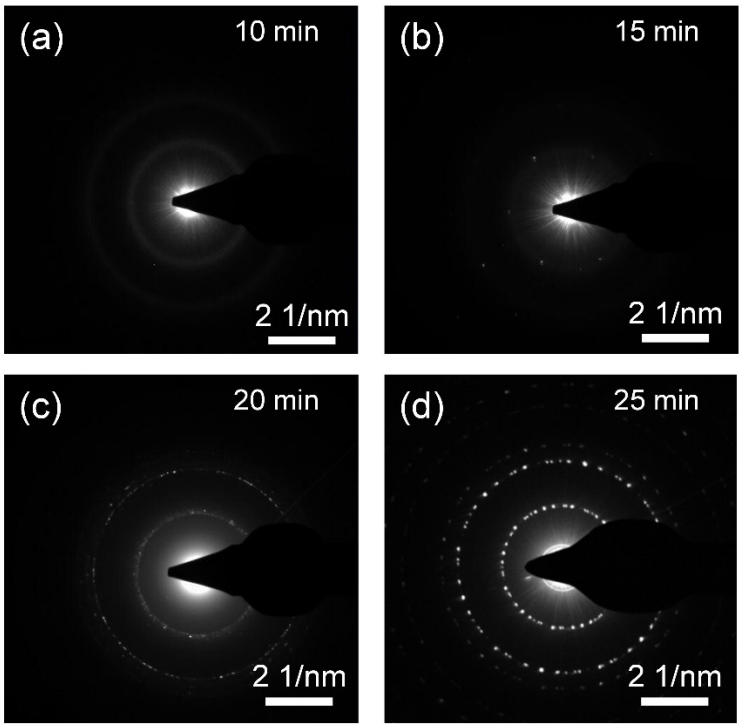

Fig. S4 (a-d) SAED patterns of VGNPs directly grown on SiO_2 substrates for growth time of 10 min, 15 min, 20 min and 25 min, respectively, with I_{RF} of 400 W in 550 ^{o}C.

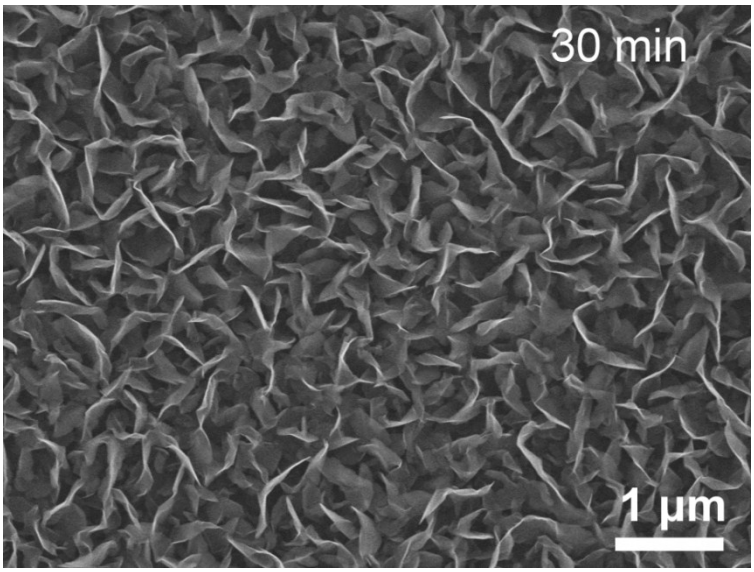

Fig. S5 SEM images of VGNPs directly grown on SiO_2 substrate for growth time of 30 min, with I_{RF} of 400 W at 550 ^oC.

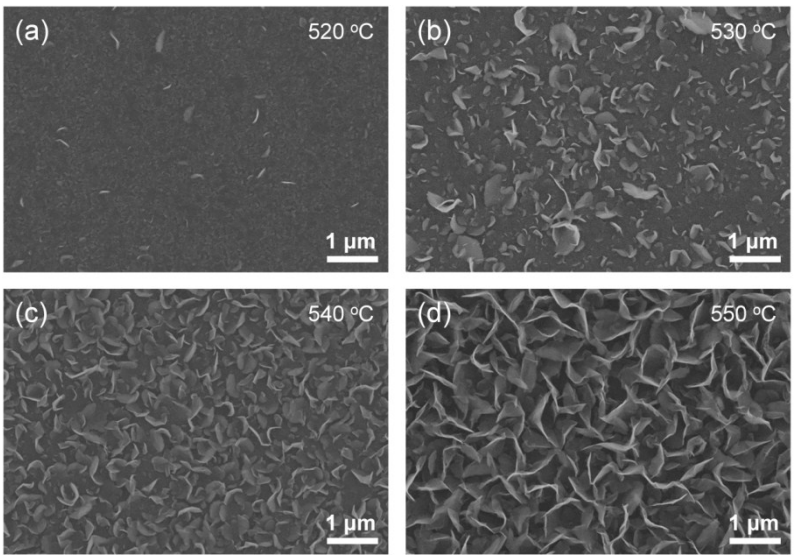

Fig. S6 SEM images of VGNPs directly grown on SiO_2 substrates for growth temperature of 520 ^oC, 530 ^oC, 540 ^oC and 550 ^oC, respectively, with I_{RF} of 400 W in 25 min.

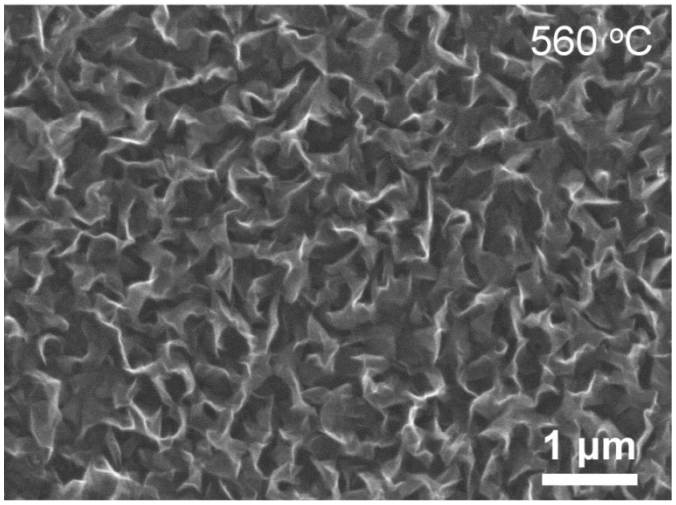

Fig. S7 SEM image of VGNPs directly grown on SiO_2 substrate for growth temperature of 560 °C, with I_{RF} of 400 W in 25 min.

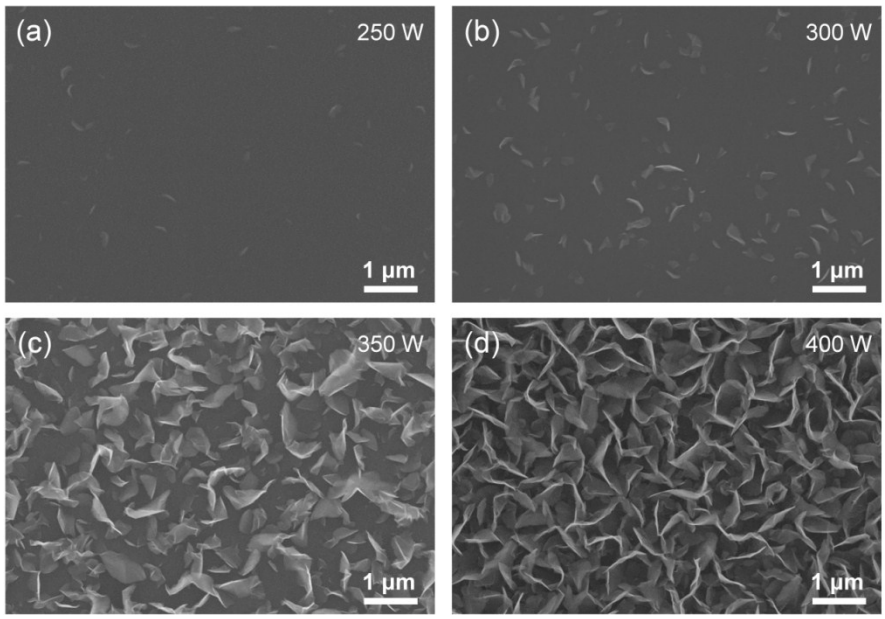

Fig. S8 SEM images of VGNPs directly grown on SiO_2 substrates for plasma power of 250 W, 300 W, 350 W and 400 W, respectively, with growth time of 25 min at 550 °C.

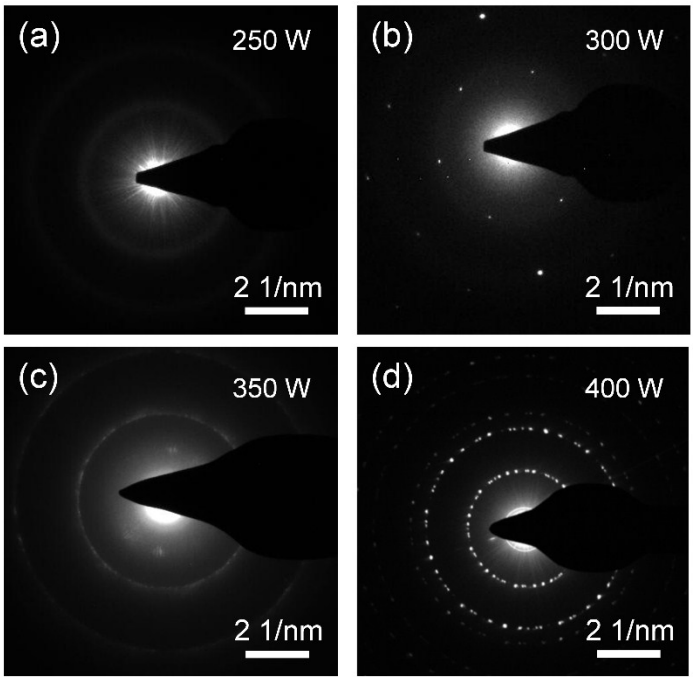

Fig. S9 (a-d) SAED patterns of VGNPs directly grown on SiO_2 substrates for plasma power of 250 W, 300 W, 350 W and 400 W, respectively, with growth time of 25 min at 550 ^oC.

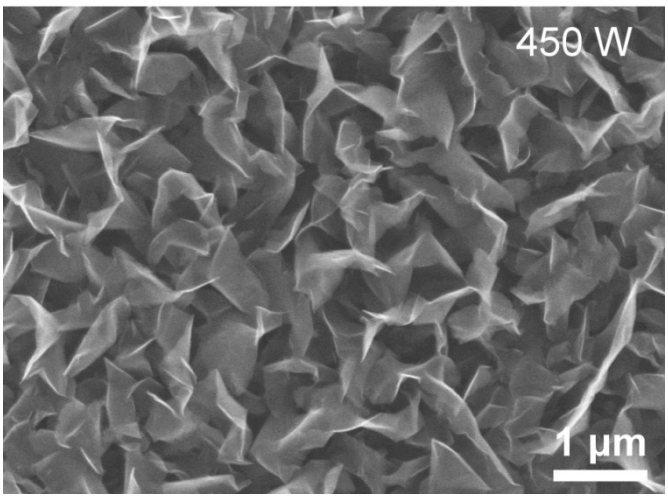

Fig. S10 SEM image of VGNPs directly grown on SiO_2 substrate for plasma power of 450 W, with growth time of 25 min at 550 ^oC

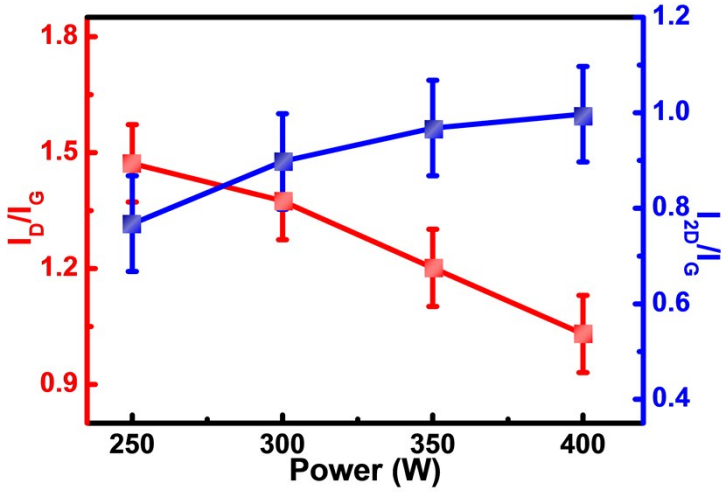

Fig. S11 The intensity ratios I_D/I_G and I_{2D}/I_G of VGNPs directly grown on SiO_2 substrates for plasma power of 250 W, 300 W, 350 W and 400 W, respectively, with growth time of 25 min at 550 °C.

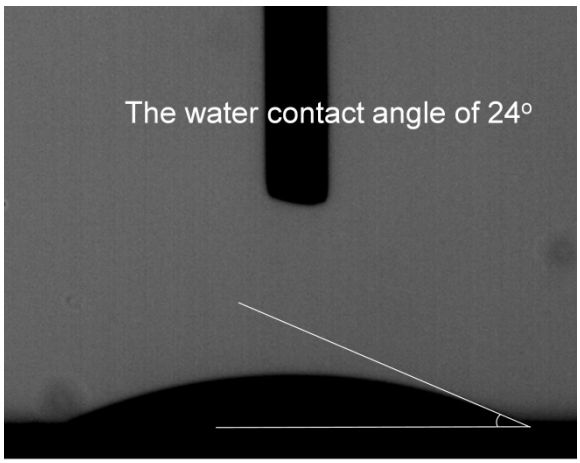

Fig. S12 The CA of SiO_2 without growth.

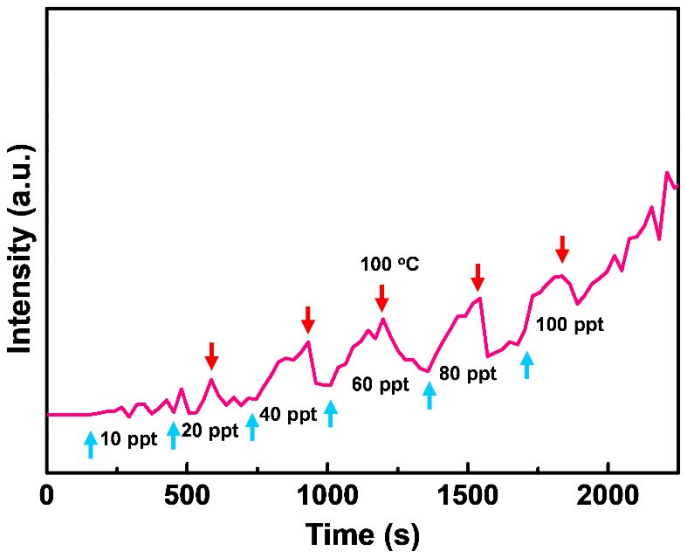

Fig. S13 Percentile resistance versus time recorded with NH_3 exposures ranging from 10 to 100 ppt. The adsorption step is performed at room temperature, while Joule heating to 100 ^oC is used during desorption. The gas sensing performance of the as-grown VGNPs based on grown time exceed 25 min with I_{RF} of 400 W