



Supplementary Materials

Direct Growth of Patterned Vertical Graphene Using Stress Mismatch between Sacrificial Layer and Substrate

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Table S1. Physical and mechanical properties used in the simulation of stress distribution.

	Thermal conductivity		CTE		Elastic modulus		Poisson's ratio		References
	T (°C)	λ (W/m·K)	T (°C)	α (10 ⁻⁶ /K)	T (°C)	E (GPa)	T (°C)	ν	
Si	20	139.4	27	2.59	25	168.1	27	0.278	[42-45]
	200	82.4	127	3.2	100	167.6			
	400	50.3	227	3.59	200	166.6			
	600	36.7	327	3.83	300	164.8			
	800	27.4	427	3.99	400	163.2			
	1000	23.7	527	4.1	500	162.4			
					600	160.3			
SiO ₂			0	0.4	0	71.8	27	0.19	[46-49]
			100	0.62	100	71.4			
			200	0.75	200	70.8			
	27	1.3	300	0.7	300	70.5			
			400	0.65	400	70.2			
			500	0.6	500	70.1			
			600	0.5	600	70.05			
Cr	27	93	127	8.12	27	275	27	0.21	[50-53]
	127	91.8	227	9	77	274			
	227	87.7	327	9.58	127	273			
	327	83.3	427	10.1	177	272			
	427	78.8	527	10.8	227	270			
	527	74.9	627	11.3	277	268			
	627	71.8	727	11.8	327	265			
	727	69.6	827	12.2	377	262			
			927	12.7					
VG	27	2000					27	0.16	[54-57]
	127	1200	27	−1.1	27	49			
	227	1010	100	−0.4	200	50			
	327	900	200	0.5	400	51			
	427	690	300	1.4	600	53			
	527	600	400	2.3	800	55			

627	510	500	3.3	1000	61
727	500				

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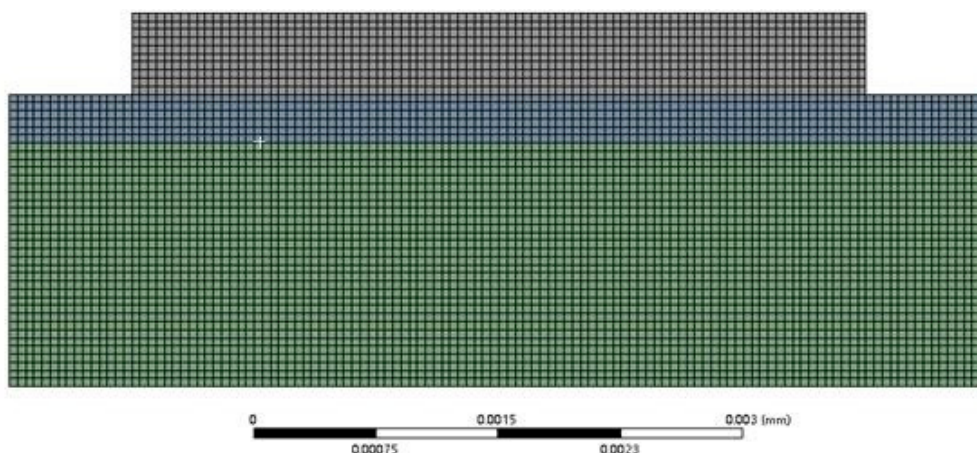


Figure S1. FE model for thermal stress analysis of a SiO₂/Si substrate with patterned Cr film (before VG synthesis).

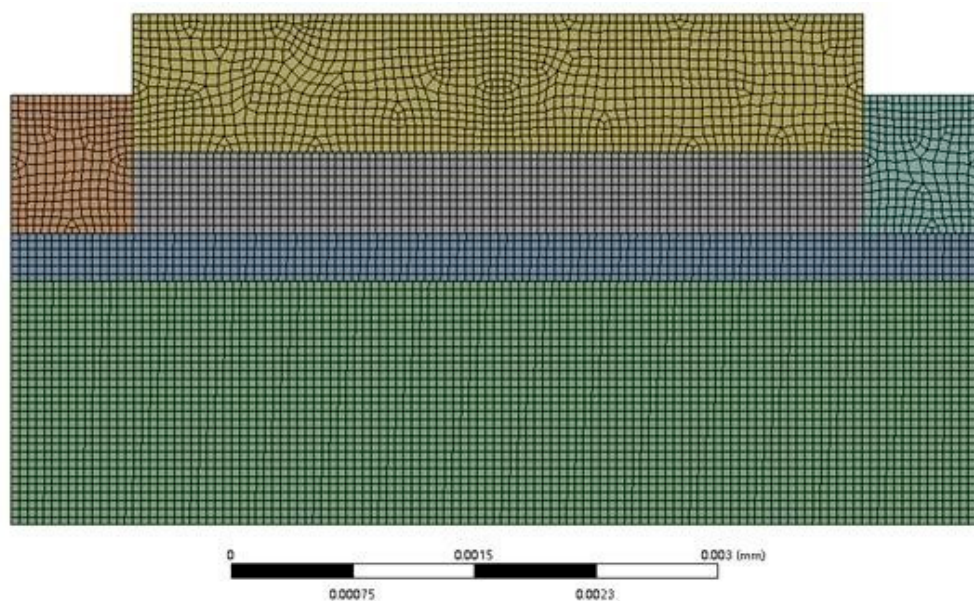


Figure S2. FE model for thermal stress analysis of a SiO₂/Si substrate with VG and patterned Cr film (after VG synthesis).

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