

JEOL 2010 TEM Calibrations

By Dr. Zhiping Luo, Microscopy and Imaging Center, Texas A&M University

The TEM imaging magnifications were calibrated using standards of 6H SiC single-crystal lattice fringes (hexagonal structure with $a = 0.30807$ nm, $c = 1.51174$ nm and space group of $P6_3mc$) for higher magnifications at and above $\times 100,000$ [1], and commercial cross-line grating replica (2160 lines/mm) for lower magnifications at and below $\times 80,000$.

Reference:

[1] Z.P. Luo. Crystallography of SiC/MgAl₂O₄/Al interfaces in a pre-oxidized SiC reinforced SiC/Al composite. *Acta Materialia* **54**, 47-58 (2006).

ORIOUS CCD Camera Magnification Calibration

	Nominal Magnification	Calibrated Magnification
Grating replica, LOW MAG (alpha=3)	50	84.77
	80	123.21
	100	150.65
	150	220.68
	200	280.81
	250	346.15
	300	424.44
	400	569.15
	500	738.60
	600	871.62
	800	1,199.42
	1,000	1,495.14
	1,200	1,723.29
	1,500	2,120.68
	Grating replica, MAG 1(alpha=3)	2,000
3,000		4,257.50
4,000		5,857.13
5,000		7,275.53
6,000		8,858.60
Grating replica, MAG 1(alpha=2)	8,000	11,250.90
	10,000	14,448.30
	12,000	17,587.50
	15,000	21,244.00
	20,000	29,576.40
	25,000	36,000.10
	30,000	42,561.50
	40,000	56,544.40
	50,000	72,246.30
	60,000	91,108.90
SiC, MAG 1(alpha=2)	80,000	120,451.00
	100,000	150,693.00
	120,000	178,106.00
	150,000	217,866.00
	200,000	286,243.00
	250,000	355,926.00
	300,000	429,752.00
	400,000	578,776.00

	500,000	722,026.00
	600,000	878,493.00
	800,000	1,092,660.00
	1,000,000	1,431,840.00
	1,200,000	1,729,740.00
	1,500,000	2,140,410.00

ORIOUS CCD Camera Camera-length (C.L.) Calibration

Nominal C.L. (mm)	Calibrated C.L. (mm)
80	116.269
100	137.175
120	179.617
150	221.983
200	290.762
250	362.94
300	412.414
400	581.85
500	727.648
600	849.351
800	1149.74
1000	1466.11
1200	1759.03
1500	2190.46
2000	2821.66

Film Camera Magnification Calibration

<u>Nominal mag</u>	<u>Calibrated mag</u>	<u>Error (%)</u>	
1,000,000	992,234	-0.78	
800,000	777,250	-2.84	
600,000	641,645	6.94	
500,000	529,192	5.84	
400,000	416,738	4.18	
300,000	317,515	5.84	
250,000	257,981	3.19	
200,000	205,062	2.53	
150,000	157,104	4.74	
120,000	125,683	4.74	
100,000	102,369	2.37	
80,000	81,976	2.47	
60,000	62,288	3.81	
50,000	50,545	1.09	
40,000	39,652	-0.87	
30,000	29,117	-2.94	
25,000	24,985	-0.06	
20,000	19,473	-2.64	
15,000	14,710	-1.93	
12,000	12,038	0.32	
10,000	9,952	-0.48	
8,000	7,981	-0.24	
6,000	6,048	0.80	
5,000	5,076	1.52	
4,000	3,996	-0.10	
3,000	2,916	-2.80	Low Mag mode
3,000	2,938	-2.07	Low Mag mode
2,500	2,419	-3.24	Low Mag mode
2,000	1,955	-2.25	Low Mag mode
1,500	1,436	-4.27	Low Mag mode
1,200	1,188	-1.00	Low Mag mode
1,000	999	-0.10	Low Mag mode

Film Camera Camera-length (C.L.) Calibration

<u>Nominal C.L. (cm)</u>	<u>Calibrated C.L. (cm)</u>	<u>Error (%)</u>	<u>Camera constant (Å·mm)</u>
150	152.99	1.99	38.4
100	102.39	2.39	25.7
80	79.8	-0.25	20.03
60	59.63	-0.62	14.97
50	51.2	2.40	12.85
40	40.91	2.27	10.27