

Peak Position	CuAlO <sub>2</sub> 35-1401	CuAl <sub>2</sub> O <sub>4</sub> 33-0448	CuO 45-0937	Cu <sub>4</sub> O <sub>3</sub> 49-1830	AlCu 26-0016	Al <sub>2</sub> O <sub>3</sub> 46-1212	Al(OH) <sub>3</sub> 20-0011	AlOOH 21-1307	Cu <sub>2</sub> O 05-0667
32.81			32.497 (-110) RI: 8						
36.28	36.690 (101) RI: 47	36.868 (311) RI: 100		36.343 (004) RI: 16			36.963 (-210) RI: 2		36.419 (111) RI: 100
37.62	37.851 (012) RI: 100					37.777 (110) RI: 21			
44.00		44.856 (400) RI: 16		44.324 (213) RI: 1	44.187 (020) RI: 80				
44.70		44.856 (400) RI: 16		44.324 (213) RI: 1	44.670 (-511) RI: 100				
51.39			51.381(112) RI: 1				51.753 (231) RI: 2	51.596 (220) RI: 6	
59.34		59.422 (511) RI: 25				59.740 (211) RI: 1	59.430 ( 241) RI: 8		

Table S1: Impurity Peak positions of CuO coated Al<sub>2</sub>O<sub>3</sub> post annealing at 1100°C corresponding to the sample shown in figure 4c (i) and possible PDF card matches (RI = peak relative intensity)

Peak Position	CuAlO <sub>2</sub> 35-1401	CuAl <sub>2</sub> O <sub>4</sub> 33-0448	CuO 45-0937	Cu <sub>4</sub> O <sub>3</sub> 49-1830	AlCu 26-0016	α-Al <sub>2</sub> O <sub>3</sub> 46-1212	Al(OH) <sub>3</sub> 20-0011	AlOOH 21-1307	Cu <sub>2</sub> O 05-0667	α-Al <sub>2</sub> O <sub>3</sub> 50-1496	δ-Al <sub>2</sub> O <sub>3</sub> 47-1292	K-Al <sub>2</sub> O <sub>3</sub> 52-0803	γ-Al <sub>2</sub> O <sub>3</sub> 50-0741
19.5										19.625 (110) RI: 54	19.331 (111) RI: 56	19.848 (002) RI: 11	19.348 (111) RI: 50
31.6										31.635 (21-2) RI: 4	31.820 (220) RI: 93	31.833 (013) RI: 75	31.855 (220) RI: 75
32.79			32.497 (-110) RI: 8										
35.70			35.496 (002), (-111) RI: 100	35.641 (211) RI: 1 35.788 (202) RI: 100	35.094 (-312) RI: 45		35.744 (130) RI: 2						
36.84	36.690 (101) RI: 47	36.868 (311) RI: 100		36.343 (004) RI: 16			36.963 (-210) RI: 2		36.419 (111) RI: 100				
37.74	37.851 (012) RI: 100					37.777 (110) RI: 21				37.690 (121) RI: 74	37.507 (311) RI: 100		37.539 (311) RI: 90
44.80		44.856 (400) RI: 16		44.324 (213) RI: 1	44.670 (-511) RI: 100								
45.40					45.068 (-313) RI: 100		45.716 (-221) RI: 4 45.474 (-140) RI: 2	45.790 (131) RI: 6			45.619 (400) RI: 3		45.668 (400) RI: 100
49.50							49.642 (141) RI: 2 49.903 (032) RI: 2	49.212 (200) RI: 25			49.991(331) RI: 7	49.716 (213) RI: 5 49.954 (124) RI: 5	
51.40			51.381 (112) RI: 1				51.753 (231) RI: 2	51.596 (220) RI: 6					
59.10		59.422 (511) RI: 25				59.740 (211) RI: 1	59.430 ( 241) RI: 8						

Table S2: Impurity Peak positions of CuAlO<sub>2</sub> coated Al<sub>2</sub>O<sub>3</sub> post annealing at 1100°C corresponding to the sample shown in figure 4c (ii) and possible PDF card matches. (RI = peak relative intensity)