

## Electronic Supplementary Information

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### The effect of preparation method on thermal and chemical reducibility of Cu-Al oxides

Camila Teixeira, Samara Montani, Luz Amparo Palacio, Fatima Zotin\*

*Universidade do Estado do Rio de Janeiro, Instituto de Química, Rua São Francisco Xavier, 524, CEP:  
20550-900*

*Rio de Janeiro – RJ, Brasil.*

*\*fmzzotin@gmail.com*

Table S1. Indexing and refinement of unit cell of CuAl-HT precursor

<i>a</i> (Å)	<i>b</i> (Å)	<i>c</i> (Å)	$\alpha$ (°)	$\beta$ (°)	$\gamma$ (°)
3.0687	3.0687	22.663	90.00	90.00	120.00
<i>h</i>	<i>k</i>	<i>l</i>	$2\theta_{obs}$ (°)	$2\theta_{calc}$ (°)	$2\theta_{obs}-2\theta_{calc}$ (°)
0	0	3	11.64	11.7048	-0.0648
0	0	6	23.57	23.534	0.036
1	0	1	34.13	33.9359	0.1941
0	1	5	39.35	39.2664	0.0836
0	1	8	47.05	46.8349	0.2151
1	0	10	52.88	53.0637	-0.1837
1	1	0	60.2	60.2697	-0.0697

Table S2. Theoretical and experimental H<sub>2</sub> consumption, reduction percentage and percentage contribution of each peak in H<sub>2</sub> consumption in TPR profiles

Sample	H <sub>2</sub> consumption ( $\mu\text{mol H}_2 \text{ gcat}^{-1}$ )		Reduction (%)	TPR peaks <sup>a</sup>		
	Theoretical	Experimental		219-228°C	253-260°C	278-290°C
CuAl HT-c	11209	9800	87	219°C (60.6 %)	253°C (39.4 %)	-
CuAl-p	11433	11413	99	228°C (71.7 %)	256°C (28.3 %)	-
CuAl-s	11118	10117	91	226°C (27.5%)	258°C (41.7%)	287°C (30.8%)
CuAl-o	11118	9881	89	-	260°C (56.2%)	284°C (43.8%)
CuO	12520	11514	92	-	-	290°C (100%)

<sup>a</sup>Maximum temperature and area percentage (between parenthesis) of the reduction peak for each temperature range in TPR

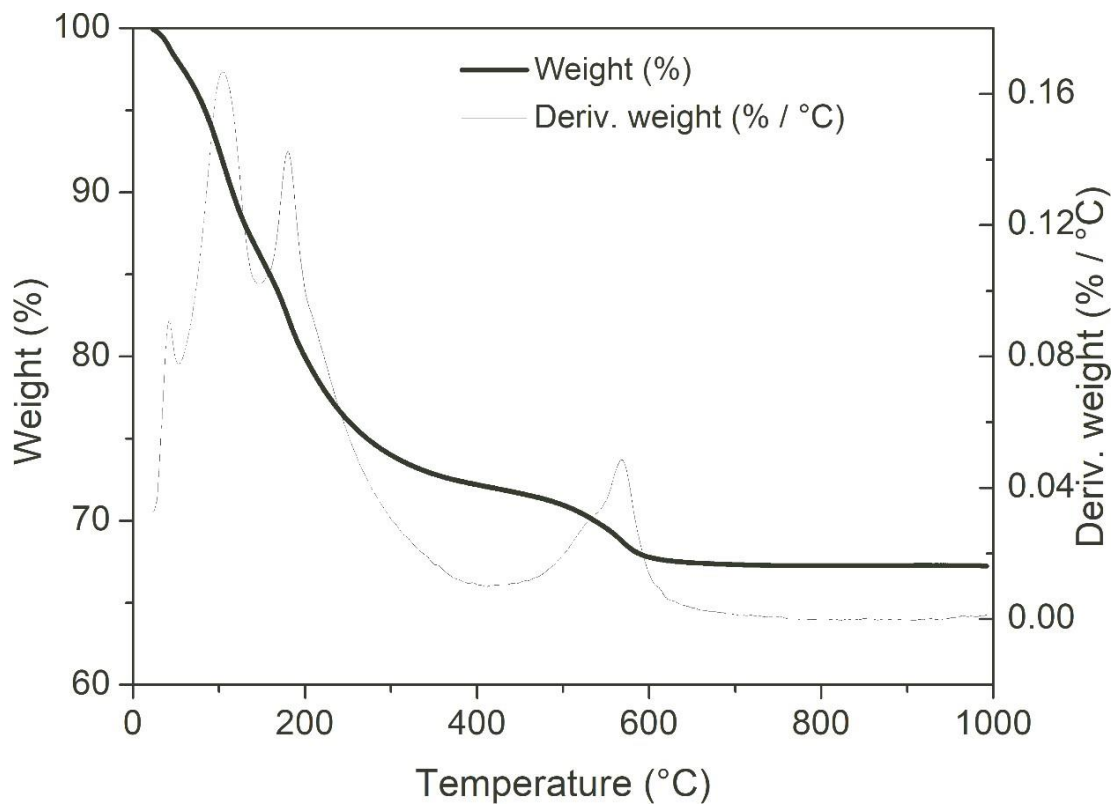


Figure S1. Thermogravimetric analysis of CuAl-HT precursor

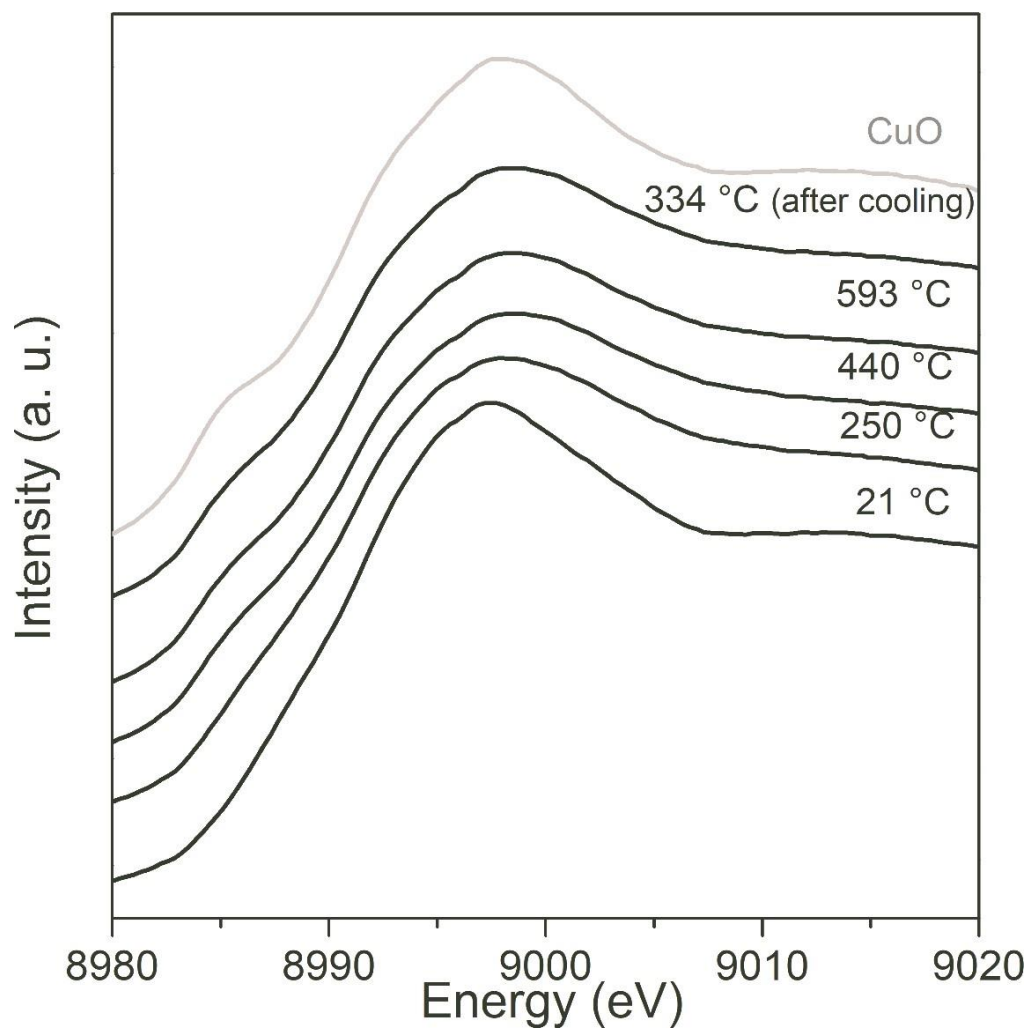


Figure S2. Cu K-edge XANES of CuAl-HT spectra during thermal treatment under ar and CuO reference spectra

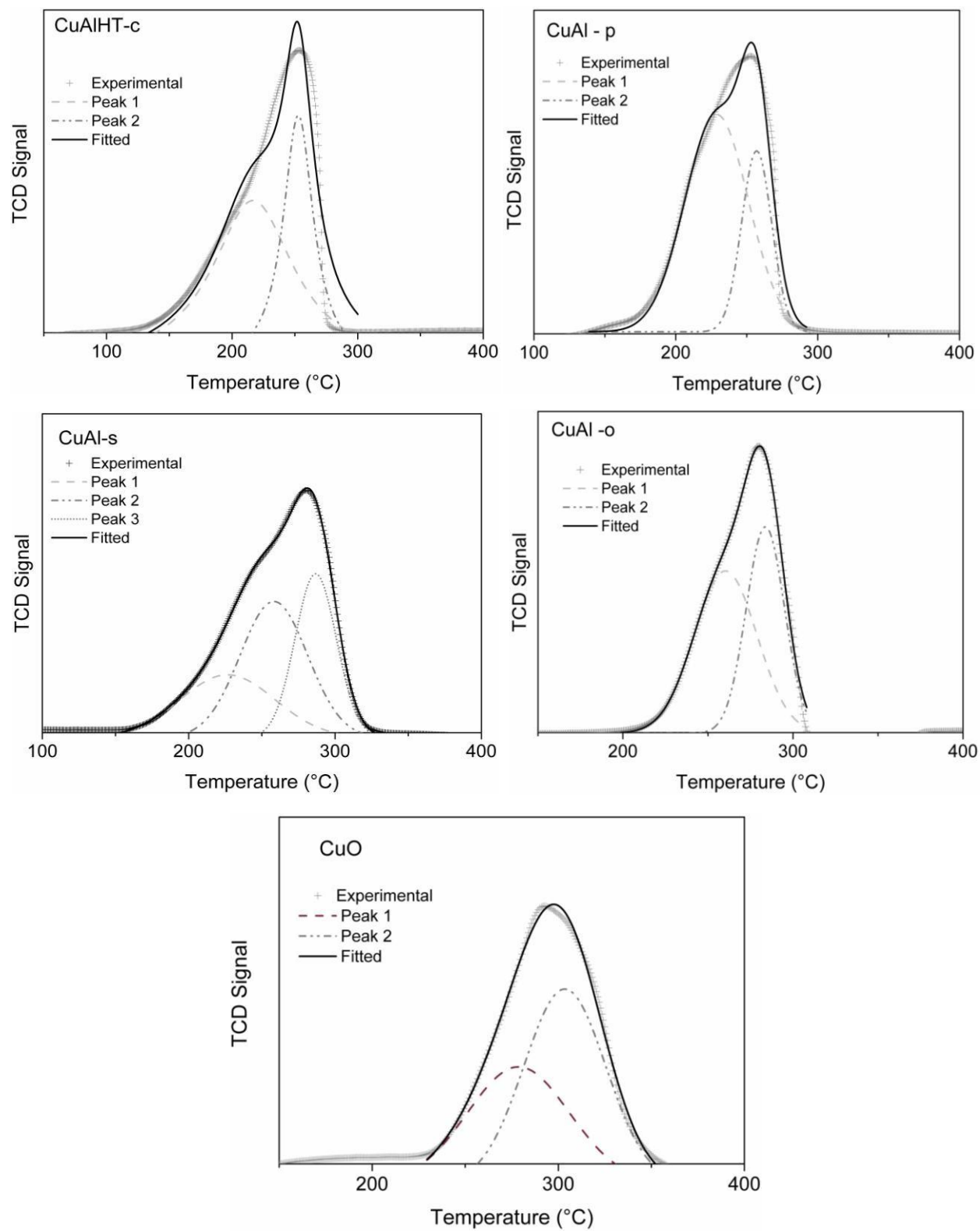


Figure S3. Deconvolution of TPR profiles\*

\* deconvolution parameters

Sample	Peak	$x_c$	w	A
CuAl HT-c	1	218.87	58.57	11.19
	2	253.05	26.94	7.29
CuAl-o	1	260.32	36.90	11.69
	2	283.78	22.59	9.08
CuAl-p	1	227.77	44.78	16.96
	2	256.99	21.15	6.66
CuAl-s	1	226.52	64.88	6.40
	2	258.22	46.10	9.86
	3	286.79	28.18	7.26
CuO	1	278.56	54.85	11.54
	2	303.46	43.80	15.37

Gaussian function was used for fitting all the peaks:

$$y = \frac{A}{\sigma \sqrt{2\pi}} \exp\left(-\frac{(x - x_c)^2}{2\sigma^2}\right)$$

where:

$x_c$ : Center of the peak.

w: standard deviation, approximately 0.849 the width of the peak at half height.

A: total area under the curve.

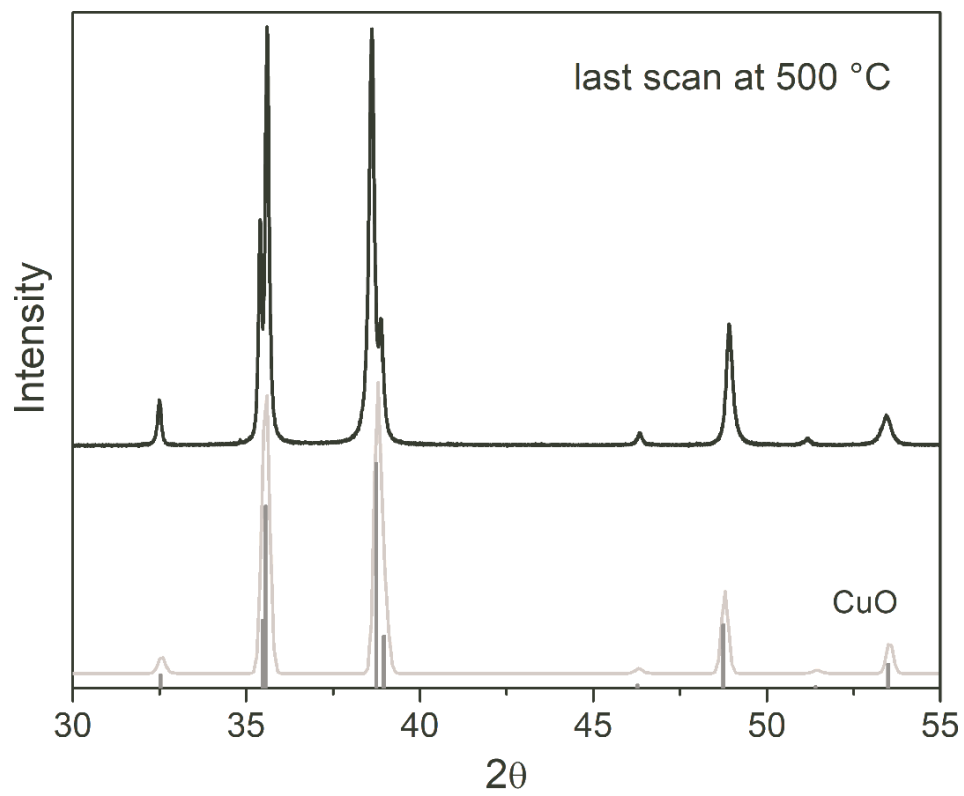


Figure S4. XRD of CuAl-o at 500 °C and CuO pattern (light gray: conventional pattern, gray: pattern with finer width peak)