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Supporting information for article:

***In-situ* Observation of Phase Changes of a Silica Supported Cobalt Catalyst for the Fischer-Tropsch Process by the Development of a Synchrotron-Compatible *In-situ/Operando* Powder X-ray Diffraction Cell**

Adam S. Hoffman, Joseph A. Singh, Stacey F. Bent and Simon R. Bare

Table S1 List of common capillary materials and suggested manufacturers used in synchrotron-based *in-situ* powder XRD cells.

Capillary Material	Manufacturer ^a
Borosilicate glass	Charles Supper Hilgenberg GmbH Friedrich & Dimmok
Quartz	Charles Supper Hilgenberg GmbH Friedrich & Dimmok
Polyimide	Cole Parmer Small Parts
Sapphire	Saint-Gobain Crystals
Glassy carbon	Sigradur
Beryllium	Materion

^aThis is not a complete list of manufacturers, but representative of manufacturers that have been used by the authors and/or mentioned in other works (Chupas *et al.*, 2008, Clausen *et al.*, 1991, Jensen *et al.*, 2010, Tsakoumis *et al.*, 2012).

S1. Additional Figures

Figure S1 Inlet block of the capillary cell with the D-shaped peg highlighted in blue. The peg allows for mounting of the cell to goniometer heads in a distinct orientation, using the flat section of the peg as a reference.

Figure S2 Hand-wound Kanthal A-1 heating elements, noted by arrow, around an alumina tube held in place by stainless steel support rods.

Figure S3 Thermal and safety shield 3D-printed form Nylon that encases the section that holds the capillary in the cell.

Figure S4 Heat reflector assembly allowing for temperature operation up to 1373K.

Figure S5 XRD pattern characterizing an empty 1.5 mm OD x 1 mm ID borosilicate capillary. Detector angle corresponds to the physical position of the detector arm with respect to the incident beam with an angle of 0° corresponding to the detector coincident to the beam. The sudden drop-off at 55° corresponds to shielding of the diffracted beam from the detector by the cell.

Figure S6 XRD pattern characterizing an empty 1.5 mm OD x 1 mm ID borosilicate capillary.

S2. Schematic of Capillary Cell

Refer to the following pages for complete schematics of the capillary cell.

DRAWN A. S. Hoffman	5/3/2017	SSRL Chemistry & Catalysis		
CHECKED				
QA		TITLE		
MFG		R2 - Capillary Cell Complete Assembly		
APPROVED		SIZE B	DWG NO R2-CAPHTR-01	REV 1
		SCALE 1 : 1	SHEET 1 OF 1

CAPILLARY SUPPORT ASSEMBLY
R2-CAPHTR-10

FILAMENT ASSEMBLY
R2-CAPHTR-09
[ONE OF TWO]

HEATER SUPPORT POST
R2-CAPHTR-08
[ONE OF TWO]

OUTLET BLOCK ASSEMBLY
R2-CAPHTR-03

STRUCTURAL ROD
R2-CAPHTR-16
[ONE OF TWO]

OUTLET BLOCK ASSEMBLY [RH]
R2-CAPHTR-06R

REQUIRED HARDWARE:
4-40 SET SCREWS QTY: 22

DRAWN A. S. Hoffman	5/3/2017	SSRL Chemistry & Catalysis		
CHECKED				
QA		TITLE		
MFG				
APPROVED		R2 - Capillary Cell Cell Assembly		
		SIZE A	DWG NO R2-CAPHTR-02	REV 1
		SCALE 1 : 1	SHEET 1 OF 1

DRAWN A. S. Hoffman	5/3/2017	SSRL Chemistry & Catalysis		
CHECKED				
QA		TITLE		
MFG				
APPROVED		R2 - Inlet Block Assembly		
		SIZE A	DWG NO R2-CAPHTR-03	REV 1
		SCALE 1 : 1	SHEET 1 OF 1	

4-40 TAPPED
THRU TO Ø .250 HOLE
6 PLACES EACH SIDE

Ø.250 $\begin{smallmatrix} +.002 \\ -.000 \end{smallmatrix}$ THRU
8 PLACES

Ø .125 $\begin{smallmatrix} \nabla \\ \nabla \end{smallmatrix}$.500
16-NPT

Ø.394

Ø.315

Ø .125 THRU

Ø .250 $\begin{smallmatrix} \nabla \\ \nabla \end{smallmatrix}$.438
1/16-27 NPT REVERSE SIDE

1.938

1.438

.875

.313

.313

.750

1.188

1.500

.750

.250

4-40 TAPPED
THRU TO Ø .250 HOLE
2 PLACES

QUANTITY: 1
MATERIAL: 6061 ALUMINUM

SECTION A-A
SCALE 1 : 1

DRAWN A. S. Hoffman	5/2/2017	SSRL Chemistry & Catalysis		
CHECKED				
QA		TITLE		
MFG				
APPROVED		R2 - Inlet Block		
		SIZE A	DWG NO R2-CAPHTR-04	REV 1
		SCALE 1 : 1	SHEET 1 OF 1

Ø .394
10 mm [REF]

Ø.250

.170

.197

.938

.500

.461

A

45°

DETAIL A
SCALE 5 : 1

QUANTITY: 1
MATERIAL: 6061 ALUMINUM

DRAWN A. S. Hoffman	5/2/2017	SSRL Chemistry & Catalysis		
CHECKED				
QA		TITLE		
MFG				
APPROVED		R2 - 10 mm Stud for Inlet Block		
		SIZE	DWG NO	REV
		A	R2-CAPHTR-05	1
		SCALE	SHEET 1 OF 1

LINEAR BEARING
R2-CAPHTR-15
LIGHT PRESS FIT
2 PLACES

SECTION A-A
SCALE 1 : 1

QUANTITY: 1

DRAWN A. S. Hoffman	5/3/2017	SSRL Chemsitry & Catalysis			
CHECKED					
QA					
MFG					
APPROVED		R2 - Outlet Block Assembly LH			
		SIZE A	DWG NO R2-CAPHTR-06L	REV 1	
		SCALE 1 : 1	SHEET 1 OF 1		

1/16 TUBE TO 1/16 NPT
R2-CAPHTR-13

OUTLET BLOCK
R2-CAPHTR-07

1/8 TUBE TO 1/16 NPT
R2-CAPHTR-14

1/16 TUBE TO 1/16 NPT
R2-CAPHTR-13

SECTION B-B
SCALE 1 : 1

LINEAR BEARING
R2-CAPHTR-15
LIGHT PRESS FIT
2 PLACES

SECTION B-B
SCALE 1 : 1

SECTION A-A
SCALE 1 : 1

QUANTITY: 1

DRAWN A. S. Hoffman	5/3/2017	SSRL Chemistry & Catalysis		
CHECKED				
QA		TITLE		
MFG				
APPROVED		R2 - Outlet Block Assembly RH		
		SIZE A	DWG NO R2-CAPHTR-06R	REV 1
		SCALE 1 : 1	SHEET 1 OF 1

QUANTITY: 2
MATERIAL: 316 SS

DRAWN A. S. Hoffman	5/3/2017	SSRL Chemistry & Catalysis		
CHECKED				
QA		TITLE R2 - Heater Support Post		
MFG				
APPROVED		SIZE A	DWG NO R2-CAPHTR-08	REV 1
		SCALE 1 : 1	SHEET 1 OF 1

QUANTITY: 4

DRAWN A. S. Hoffman	5/3/2017	SSRL Chemistry & Catalysis		
CHECKED				
QA		TITLE R2 - Filament Assembly		
MFG				
APPROVED		<div>SIZE</div> <div>A</div>		
		<div>DWG NO</div> <div>R2-CAPHTR-09</div>		<div>REV</div> <div>1</div>
		<div>SCALE</div> <div>1 : 1</div>		SHEET 1 OF 1

QUANTITY: 6
MATERIAL: 6061 ALUMINUM

DRAWN A. S. Hoffman	5/3/2017	SSRL Chemistry & Catalysis		
CHECKED				
QA		TITLE		
MFG				
APPROVED		R2 - Capillary Support U Frame		
		SIZE A	DWG NO R2-CAPHTR-11	REV 1
		SCALE 1 : 1	SHEET 1 OF 1

QUANTITY: 1
MATERIAL: 6061 ALUMINUM

DRAWN A. S. Hoffman	5/3/2017	SSRI Chemistry & Catalysis		
CHECKED				
QA		TITLE		
MFG				
APPROVED		R2 - X-48 to Capillary Cell Adapter Plate		
		SIZE A	DWG NO R2-CAPHTR-12	REV 1
		SCALE 1 : 1	SHEET 1 OF 1	

R2-CAPHTR-13
1/16 TUBE TO 1/16 NPT
SWAGELOK # SS-100-1-1
QUANTITY: 5

R2-CAPHTR-14
1/8 TUBE TO 1/16 NPT
SWAGELOK # SS-200-1-1
QUANTITY: 3

R2-CAPHTR-15
LINEAR BEARING FOR Ø 1/4 SHAFT
MCMASTER-CARR # 8974T14
QUANTITY: 4

R2-CAPHTR-16
Ø .250 PRECISION SHAFT
8" LONG
316 SS
MCMASTER-CAR # 1263K177
QUANTITY: 2

R2-CAPHTR-17
CERAMIC TUBE
OMEGA # TRA-13218-1
Ø .125, WIHT TWO Ø 1/32 HOLES
1" LONG
QUANTITY: 12

R2-CAPHTR-18
FILAMENT WIRE
KANTHAL A-1
Ø .020
QUANTITY: 4

R2-CAPHTR-19
1/8 PORT CONENCTOR
SWAGELOK # SS-201-PC
QUANTITY: 12

R2-CAPHTR-20
1/8 CAP
SWAGELOK # SS-200-C
QUANTITY: 12

DRAWN A. S. Hoffman	5/3/2017	SSRL Chemistry & Catalysis		
CHECKED				
QA		R2 - Commercial Parts		
MFG				
APPROVED		R2-Commercial Parts		
		SIZE B	DWG NO R2-Commercial Parts	REV 1
		SCALE 1 : 1	SHEET 1 OF 1	