Supplementary Material (ESI) for Green Chemistry

Supporting Information

Bimetallic catalysts for the Fischer-Tropsch reaction

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Table 1

In this table are summarized the details about the composition, the preparation method and the pretreatments (drying, calcination, reduction) time and temperature of all the catalysts mentioned in the review.

Table 2

In this table are summarized the testing conditions and the main test figures (activity and selectivity) of all the catalysts mentioned in the review.

Missing figures in the tables were not provided in the reviewed papers by the authors.

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Table 1: Catalyst preparation details

Entry	Catalyst	Surface area; crystallite size	Preparation Method[#]	Precursors, solvent, synthesis temperature	Drying Temperature (˚C)/ time (h)	Calcination Temperature (˚C)/ time (h)	Reduction Temperature (˚C)/ time (h)	Phase	Reference
1	10%Fe/TiO_2		a	Nitrates, H_2O, r.t.	110/4	300/4	400/2	Fe + Fe_3O_4	21
2	10%Co/TiO_2		a	Nitrates, H_2O, r.t.	110/4	300/4	400/2		21
3	10%($_{75}Fe_{25}Co$)/TiO_2		a	Nitrates, H_2O, r.t.	110/4	300/4	400/2	Metal	21
4	10%($_{50}Fe_{50}Co$)/TiO_2		a	Nitrates, H_2O, r.t.	110/4	300/4	400/2	Metal	21
5	10%($_{25}Fe_{75}Co$)/TiO_2		a	Nitrates, H_2O, r.t.	110/4	300/4	400/2	Metal	21
6	4,94%Fe/silica		a	Nitrates, H_2O, r.t.	125/18	200/2; 450/4	425/24	bcc, ε' χ Carbide (FT)	31
7	4,61%Co/silica		a	Nitrates, H_2O, r.t.	125/18	200/2; 450/4	425/24	bcc	31
8	4,87%($_{80}Fe_{20}Co$)/silica		a	Nitrates, H_2O, r.t.	125/18	200/2; 450/4	425/24	fcc, hcp	31
9	4,94%Fe/silica		a	Nitrates, H_2O, r.t.	125/18	200/2; 450/4	425/24	bcc, ε' χ Carbide (FT)	31
10	4,61%Co/silica		a	Nitrates, H_2O, r.t.	125/18	200/2; 450/4	425/24	bcc	31
11	4,87%($_{80}Fe_{20}Co$)/silica		a	Nitrates, H_2O, r.t.	125/18	200/2; 450/4	425/24	fcc, hcp	31

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12	4,94%Fe/silica		a	Nitrates, H_2O, r.t.	125/18	200/2; 450/4	425/24	bcc, ε' χ Carbide (FT)	31
13	4,61%Co/silica		a	Nitrates, H_2O, r.t.	125/18	200/2; 450/4	425/24	bcc	31
14	4,87%($_{80}Fe_{20}Co$)/silica		a	Nitrates, H_2O, r.t.	125/18	200/2; 450/4	425/24	fcc, hcp	31
15	4,94%Fe/silica		a	Nitrates, H_2O, r.t.	125/18	200/2; 450/4	425/24	bcc, ε' χ Carbide (FT)	31
16	4,61%Co/silica		a	Nitrates, H_2O, r.t.	125/18	200/2; 450/4	425/24	bcc	31
17	4,87%($_{80}Fe_{20}Co$)/silica		a	Nitrates, H_2O, r.t.	125/18	200/2; 450/4	425/24	fcc, hcp	31
18	4,94%Fe/silica		a	Nitrates, H_2O, r.t.	125/18	200/2; 450/4	425/24	bcc, ε' χ Carbide (FT)	31
19	4,61%Co/silica		a	Nitrates, H_2O, r.t.	125/18	200/2; 450/4	425/24	bcc	31
20	4,87%($_{80}Fe_{20}Co$)/silica		a	Nitrates, H_2O, r.t.	125/18	200/2; 450/4	425/24	fcc, hcp	31
21	4,94%Fe/silica		a	Nitrates, H_2O, r.t.	125/18	200/2; 450/4	425/24	bcc, ε' χ Carbide (FT)	31
22	4,61%Co/silica		a	Nitrates, H_2O, r.t.	125/18	200/2; 450/4	425/24	bcc	31

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23	4,87%($_{80}Fe_{20}Co$)/silica		a	Nitrates, H_2O, r.t.	125/18	200/2; 450/4	425/24	fcc, hcp	31
24	10,9%Fe/ZrO_2	82,5 m^2/g	b	Nitrates, H_2O, r.t.	60/24	500/ 6	430/16	Zirconia	24
25	11,2%($_{78}Fe_{22}Co$)/ZrO_2	85,0 m^2/g	a,b	Nitrates, H_2O, r.t.	60/24	500/ 6	430/16	Zirconia	24
26	9,63%($_{49}Fe_{51}Co$)/ZrO_2	83,1 m^2/g	a,b	Nitrates, H_2O, r.t.	60/24	500/ 6	430/16	Zirconia + CoO + Fe_2O_3	24
27	12,47%($_{30}Fe_{70}Co$)/ZrO_2	52,5 m^2/g	a,b	Nitrates, H_2O, r.t.	60/24	500/ 6	430/16	Zirconia + CoO + Fe_2O_3	24
28	10,5%Fe/$Zr0_2$	49,4 m^2/g	a,b	Nitrates, H_2O, r.t.	60/24	500/ 6	430/16	Zirconia + Cobalt oxide	24
29	($_{30}Fe_{70}Co_{1,99}S$)/ZrO_2	148 m^2/g	a,b	Nitrates, H_2SO_4,H_2O, r.t.	110/16	350/3	430/16	Zirconia + CoO + Fe_2O_3	24
30	($_{30}Fe_{70}Co_{1,87}S$)/ZrO_2	107 m^2/g	a,b	Nitrates, H_2SO_4, H_2O, r.t.	110/16	450/3	430/16	Zirconia + CoO + Fe_2O_3	24
31	($_{30}Fe_{70}Co_{1,81}S$)/ZrO_2	92 m^2/g	a,b	Nitrates, H_2SO_4, H_2O, r.t.	110/16	550/3	430/16	Zirconia + CoO + Fe_2O_3	24
32	($_{30}Fe_{70}Co_{1,94}S$)/ZrO_2	99 m^2/g	a,b	Nitrates, H_2SO_4, H_2O, r.t.	110/16	650/1	430/16	Zirconia + CoO + Fe_2O_3	24
33	($_{30}Fe_{70}Co_{1,59}S$)/ZrO_2	80 m^2/g	a,b	Nitrates, H_2SO_4, H_2O, r.t.	110/16	650/ 2	430/16	Zirconia + CoO + Fe_2O_3	24

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Entry	Catalyst	Surface area; crystallite size	Preparation Method[#]	Precursors, solvent, synthesis temperature	Drying Temperature (˚C)/ time (h)	Calcination Temperature (˚C)/ time (h)	Reduction Temperature (˚C)/ time (h)	Phase	Reference
34	$(_{30}Fe_{70}Co_{1,49}S)/ZrO_2$	88 m^2/g	a,b	Nitrates, H_2SO_4, H_2O, r.t.	110/16	650/3	430/16	Zirconia + CoO + Fe_2O_3	24
35	$(_{30}Fe_{70}Co_{1,29}S)/ZrO_2$	87 m^2/g	a,b	Nitrates, H_2SO_4, H_2O, r.t.	110/16	650/4	430/16	Zirconia + CoO + Fe_2O_3	24
36	4,94%Fe/HZSM-5	6,0 nm	a	Nitrates, H_2O	100/overnight		425/24		25
37	4.94%Fe/HY	7,5 nm	a	Nitrates, H_2O	100/overnight		425/24		25
38	4,60%Co/HZSM-5		a	Nitrates, H_2O	100/overnight		425/24		25
39	4,61%Co/HY		a	Nitrates, H_2O	100/overnight		425/24		25
40	4.94%Fe/ZSM		a	Nitrates, H_2O	100/overnight		425/24		25
41	3%Fe/Y		c	Nitrates, H_2O	100/overnight		425/24		25
42	4,86%$(_{79}Fe_{21}Co)$/HZSM-5	7,8 nm	a	Nitrates, H_2O	100/overnight		425/24	Alloy	25
43	4,87%$(_{79}Fe_{21}Co)$/HY	7,8 nm	a	Nitrates, H_2O	100/overnight		425/24	No alloy	25
53	4,10%Co/carbon black	1,8 nm	a	Carbonyls, THF or Acetone, r.t.			200/5		9

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54	3,20%($_{25}Fe_{75}Co$)/carbon black	1,3 nm	a	Carbonyls, THF or Acetone, r.t.			200/5		9
55	2,00%($_{27}Fe_{73}Co$)/carbon black	18,7 nm	a	Carbonyls, THF or Acetone, r.t.			200/5		9
56	1,70%($_{34}Fe_{66}Co$)/carbon black	1,7 nm	a	Carbonyls, THF or Acetone, r.t.			200/5		9
57	2,00%($_{56}Fe_{44}Co$)/carbon black	4,7 nm	a	Carbonyls, THF or Acetone, r.t.			200/5		9
58	4,40%Fe/carbon black	1,1 nm	a	Carbonyls, THF or Acetone, r.t.			200/5		9
75	4,20%($_{35,7}Fe_{35,7}Co_{28,6}K$/carbon black	2,9 nm	a	Carbonyls, THF or Acetone, r.t.			400/16		9
76	($_{50}Fe_{50}Co$)	2,9 m^2/g; 0,16 mm	d	Oxides			300/72		9
77	($_{50}Fe_{50}Co$)	2,9 m2/g; 0,16 mm	d	Oxides			300/72		9
78	($_{50}Fe_{50}Co$)	2,9 m^2/g; 0,16 mm	d	Oxides			300/72		9
79	10%($_{50}Fe_{50}Co$)/TiO_2	45 m^2/g	a	Nitrates, H_2O, 80°C	120/ 2	200/16	300/16		9
80	10%($_{50}Fe_{50}Co_{0,08}K$)/TiO_2	49 m^2/g	a	Nitrates, H_2O, 80°C	120/ 2	200/16	300/16		9

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81	$10\%(_{50}Fe_{50}Co_{0,47}K)/TiO_2$	53 m^2/g	a	Nitrates, H_2O, 80°C	120/ 2	200/16	300/16		9
82	$10\%(_{50}Fe_{50}Co_{1,13}K)/TiO_2$	53 m^2/g	a	Nitrates, H_2O, 80°C	120/ 2	200/16	300/16		9
83	$10\%(_{50}Fe_{50}Co_{0,09}Cr)/TiO_2$	55 m^2/g	a	Nitrates, H_2O, 80°C	120/ 2	200/16	300/16		9
84	$10\%(_{50}Fe_{50}Co_{0,6}Cr)/TiO_2$	50 m^2/g	a	Nitrates, H_2O, 80°C	120/ 2	200/16	300/16		13
85	$10\%(_{50}Fe_{50}Co_{1,04}Cr)/TiO_2$	49 m^2/g	a	Nitrates, H_2O, 80°C	120/ 2	200/16	300/16		13
86	$10\%(_{50}Fe_{50}Co_{0,07}Mn)/TiO_2$	47 m^2/g	a	Nitrates, H_2O, 80°C	120/ 2	200/16	300/16		13
87	$10\%(_{50}Fe_{50}Co_{0,45}Mn)/TiO_2$	45 m^2/g	a	Nitrates, H_2O, 80°C	120/ 2	200/16	300/16		13
88	$10\%(_{50}Fe_{50}Co_{0,97}Mn)/TiO_2$	46 m^2/g	a	Nitrates, H_2O, 80°C	120/ 2	200/16	300/16		13
89	$10\%Fe/TiO_2$	48 m^2/g	a	Nitrates, H_2O, 80°C	120/ 2	200/16	300/16		13
90	$10\%(_{75}Fe_{25}Co)/TiO_2$	-	a	Nitrates, H_2O, 80°C	120/ 2	200/16	300/16		13
91	$10\%(_{50}Fe_{50}Co)/TiO_2$	51 m^2/g	a	Nitrates, H_2O, 80°C	120/ 2	200/16	300/16		13

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92	10%($_{25}$Fe$_{75}$Co)/TiO_2	-	a	Nitrates, H_2O, 80°C	120/ 2	200/16	300/16		13
93	10%Co/TiO_2	47 m^2/g	a	Nitrates, H_2O, 80°C	120/ 2	200/16	300/16		13
94	8%($_{50}$Fe$_{50}$Co)/TiO_2	51 m^2/g	a	Nitrates, H_2O, 80°C	120/ 2	200/16	300/16		13
95	6%($_{50}$Fe$_{50}$Co)/TiO_2	51 m^2/g	a	Nitrates, H_2O, 80°C	120/ 2	200/16	300/16		13
96	4%($_{50}$Fe$_{50}$Co)/TiO_2	51 m^2/g	a	Nitrates, H_2O, 80°C	120/ 2	200/16	300/16		13
97	2%($_{50}$Fe$_{50}$Co)/TiO_2	51 m^2/g	a	Nitrates, H_2O, 80°C	120/ 2	200/16	300/16		13
98	10%($_{50}$Fe$_{50}$Co)/TiO_2	51 m^2/g	a	Nitrates, H_2O, 80°C	120/ 2	200/16	300/16		13
99	10%($_{50}$Fe$_{50}$Co)/TiO_2	51 m^2/g	a	Nitrates, H_2O, 80°C	120/ 2	200/16	300/16		13
100	10%($_{50}$Fe$_{50}$Co)/TiO_2	51 m^2/g	a	Nitrates, H_2O, 80°C	120/ 2	200/16	300/16		13
101	10%($_{50}$Fe$_{50}$Co)/TiO_2	51 m^2/g	a	Nitrates, H_2O, 80°C	120/ 2	200/16	300/16		13
102	10%($_{50}$Fe$_{50}$Co)/TiO_2	51 m^2/g	a	Nitrates, H_2O, 80°C	120/ 2	200/16	300/16		13

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103	10%($_{50}Fe_{50}Co$)/TiO_2	51 m^2/g	a	Nitrates, H_2O, 80°C	120/ 2	200/16	300/16		13
104	10%($_{50}Fe_{50}Co$)/TiO_2	51 m^2/g	a	Nitrates, H_2O, 80°C	120/ 2	200/16	300/16		13
105	10%($_{50}Fe_{50}Co$)/TiO_2	51 m^2/g	a	Nitrates, H_2O, 80°C	120/ 2	200/16	300/16		13
106	$_{83}Fe_{17}Co$		b, e	oxides, H_2O	140/16	500/5	400/24	α-Fe_2O_3 MnO_2 Mn_3O_4 Co_3O_4	*
107	$_{77}Fe_{15}Co_8Mn$		b, e	oxides, H_2O	140/16	500/5	400/24	α-Fe_2O_3 MnO_2 Mn_3O_4 Co_3O_4	*
108	$_{71}Fe_{14,5}Co_{14,5}Mn$		b, e	oxides, H_2O	140/16	500/5	400/24	α-Fe_2O_3 MnO_2 Mn_3O_4 Co_3O_4	*
109	$_{59}Fe_{12}Co_{29}Mn$		b, e	oxides, H_2O	140/16	500/5	400/24	α-Fe_2O_3 MnO_2 Mn_3O_4 Co_3O_4	*
110	$_{45}Fe_{10}Co_{45}Mn$		b, e	oxides, H_2O	140/16	500/5	400/24	α-Fe_2O_3 MnO_2 Mn_3O_4 Co_3O_4	*
111	7,9%($_{24}Fe_{76}Co$)/SiO_2		a	Hydridic Carbonyl, Acetone, 30-40ºC	dried in vacuum		200	$FeCo_3$ cluster	18
112	7,9%($_{24}Fe_{76}Co$)/SiO_2		a	Hydridic Carbonyl, Acetone, 30-40ºC	dried in vacuum		200	$FeCo_3$ cluster	18
113	7,9%($_{24}Fe_{76}Co$)/SiO_2		a	Hydridic Carbonyl, Acetone, 30-40ºC	dried in vacuum		200	$FeCo_3$ cluster	18

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114	10%($_{50}$Fe$_{50}$Co)/TiO_2	51,0 m^2/g	a	Nitrates, H_2O, 80°C	120/16	200/16	300		48
115	10%Fe/TiO_2	86,6 m^2/g	b	Nitrates, H_2O, 80°C	120/16	none	270		48
116	10%Co/TiO_2	83,8 m^2/g	b	Nitrates, H_2O, 80°C	120/16	none	270		48
117	20%($_{50}$Fe$_{50}$Co)/TiO_2	78,3 m^2/g	b	Nitrates, H_2O, 80°C	120/16	none	270		48
118	20%($_{25}$Fe$_{75}$Co)/TiO_2	87,4 m^2/g	b	Nitrates, H_2O, 80°C	120/16	none	-		48
119	10%($_{50}$Fe$_{50}$Co)/TiO_2	76,0 m^2/g	b	Nitrates, H_2O, 80°C	120/16	none	270		48
120	15%($_{33}$Fe$_{67}$Co)/TiO_2	86,0 m^2/g	b	Nitrates, H_2O, 80°C	120/16	none	-		48
121	15%($_{67}$Fe$_{33}$Co)/TiO_2	87,1 m^2/g	b	Nitrates, H_2O, 80°C	120/16	none	-		48
122	10%Fe/TiO_2	43,5 m^2/g	a	Carbonyls, THF, r.t.	dried in vacuum for 16 h	none	250		48
123	10%Co/TiO_2	47,2 m^2/g	a	Carbonyls, THF, r.t.	dried in vacuum for 16 h	none	250		48
124	10%($_{50}$Fe$_{50}$Co)/TiO_2	48,7 m^2/g	a	Carbonyls, THF, r.t.	dried in vacuum for 16 h	none	250		48
125	10%($_{50}$Fe$_{50}$Co)/TiO_2	47,8 m^2/g	a	Mixed Carbonyl, THF, r.t.	dried in vacuum for 16 h	none	250		48

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126	10%Co/SiO_2	21 nm	a	Nitrates, H_2O, r.t.	120/16	500/2	500/2		10
127	11%($_9Fe_{91}Co$)/SiO_2	21 nm	a	Nitrates, H_2O, r.t.	120/16	500/2	500/2		10
128	15%($_{33}Fe_{67}Co$)/SiO_2	14 nm	a	Nitrates, H_2O, r.t.	120/16	500/2	500/2		10
129	10,00%Co/CNT	192	a	Nitrates, H_2O, r.t.	120/16	350/3	400/20		35
130	10,5%($_5Fe_{95}Co$)/CNT	188	a	Nitrates, H_2O, r.t.	120/16	350/3	400/20		35
131	11%($_9Fe_{91}Co$)/CNT	184	a	Nitrates, H_2O, r.t.	120/16	350/3	400/20		35
132	12%($_{17}Fe_{83}Co$)/CNT	166	a	Nitrates, H_2O, r.t.	120/16	350/3	400/20		35
133	14%($_{28}Fe_{72}Co$)/CNT	156	a	Nitrates, H_2O, r.t.	120/16	350/3	400/20		35
134	10%Fe/CNT	194	a	Nitrates, H_2O, r.t.	120/16	350/3	400/20		35

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*) S. L. Gonzales-Cortes, S. M. A. Rodulfo-Baechler, A. Oliveros, J. Orozco, B. Fontal, A. J. Mora, G. Delgado, *React. Kinet. Catal. Lett.* **2002**, 75, 3.

a) Incipient impregnation

b) Co-precipitation

c) Impregnation

d) Plasma sprying

e) Co-impregnation

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Table 2: Catalyst testing details

Entry	Catalyst	Evaluation Conditions				Activity				Selectivity	Remarks	Reference
		Temperature	Pressure	H_2/CO	Flow rate/ Contact time	CO Conversion	Specific activity	TOF	TON			
1	10%Fe/TiO_2	250°C	1 MPa	1.9	10 g*h/mol	2.2%				C_{6+}% = 8		21
2	10%Co/TiO_2	250°C	1 MPa	1.9	10 g*h/mol	20.3%				C_{6+}% = 24		21
3	10%($_{75}Fe_{25}Co$)/TiO_2	250°C	1 MPa	1.9	10 g*h/mol	5.9%				C_{6+}% = 30		21
4	10%($_{50}Fe_{50}Co$)/TiO_2	250°C	1 MPa	1.9	10 g*h/mol	28.5%				C_{6+}% = 41		21
5	10%($_{25}Fe_{75}Co$)/TiO_2	250°C	1 MPa	1.9	10 g*h/mol	14.5%				C_{6+}% = 32		21
6	4,94%Fe/silica	250°C	1 atm	3				$9*10^{-3}$	mol/site*s			31
7	4,61%Co/silica	250°C	1 atm	3				$45*10^{-3}$	mol/site*s			31
8	4,87%($_{80}Fe_{20}Co$)/silica	250°C	1 atm	3				$1,7*10^{-3}$	mol/site*s			31
9	4,94%Fe/silica	250°C	7,8 atm	3				$70,2*10^{-3}$	mol/site*s			31
10	4,61%Co/silica	250°C	7,8 atm	3				$13,8*10^{-3}$	mol/site*s			31
11	4,87%($_{80}Fe_{20}Co$)/silica	250°C	7,8 atm	3				$13,3*10^{-3}$	mol/site*s			31
12	4,94%Fe/silica	250°C	14 atm	3				$46*10^{-3}$	mol/site*s			31
13	4,61%Co/silica	250°C	14 atm	3				$24,8*10^{-3}$	mol/site*s			31
14	4,87%($_{80}Fe_{20}Co$)/silica	250°C	14 atm	3				$23,8*10^{-3}$	mol/site*s			31
15	4,94%Fe/silica	250°C	1 atm	1				$3,2*10^{-3}$	mol/site*s			31
16	4,61%Co/silica	250°C	1 atm	1				$17*10^{-3}$	mol/site*s			31

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Table 2: Catalyst testing details

Entry	Catalyst	Evaluation Conditions				Activity				Selectivity	Remarks	Reference
		Temperature	Pressure	H_2/CO	Flow rate/ Contact time	CO Conversion	Specific activity	TOF	TON			
18	4,94%Fe/silica	250°C	7,8 atm	1				$21,8*10^{-3}$	mol/site*s			31
19	4,61%Co/silica	250°C	7,8 atm	1				$9*10^{-3}$	mol/site*s			31
20	4,87%($_{80}Fe_{20}Co$)/silica	250°C	7,8 atm	1				$10*10^{-3}$	mol/site*s			31
21	4,94%Fe/silica	250°C	14 atm	1				$47,6*10^{-3}$	mol/site*s			31
22	4,61%Co/silica	250°C	14 atm	1				-	mol/site*s			31
23	4,87%($_{80}Fe_{20}Co$)/silica	250°C	14 atm	1				$10,6*10^{-3}$	mol/site*s			31
24	10,9%Fe/ZrO_2	250°C	1 atm	-	5 h^{-1}	2.60%				C_{5+} = 24 wt% C_1 = 23 wt%		24
25	11,2%($_{78}Fe_{22}Co$)/ZrO_2	250°C	1 atm	-	5 h^{-1}	2.50%				C_{5+} = 26 wt% C_1 = 25 wt%		24
26	9,63%($_{49}Fe_{51}Co$)/ZrO_2	250°C	1 atm	-	5 h^{-1}	3.00%				C_{5+} = 32 wt% C_1 = 19 wt%		24
27	12,47%($_{30}Fe_{70}Co$)/ZrO_2	250°C	1 atm	-	5 h^{-1}	3.50%				C_{5+} = 33 wt% C_1 = 20 wt%		24
28	10,5%Fe/$Zr0_2$	250°C	1 atm	-	5 h^{-1}	3.30%				C_{5+} = 35 wt% C_1 = 21 wt%		24

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Table 2: Catalyst testing details

Entry	Catalyst	Evaluation Conditions				Activity				Selectivity	Remarks	Reference
		Temperature	Pressure	H_2/CO	Flow rate/ Contact time	CO Conversion	Specific activity	TOF	TON			
29	$(_{30}Fe_{70}Co_{1,99}S)/ZrO_2$	150°C	1 atm		5 h^{-1}	3.90%				C_{5+} = 44,2 wt% C_4 = 15,9 wt% C_1 = 14,8 wt%	Double consecutive reactors: 1-Fe-Co-ZrO_2 2-SO_4^{2-}/ZrO_2	24
30	$(_{30}Fe_{70}Co_{1,87}S)/ZrO_2$	150°C	1 atm		5 h^{-1}	4.20%				C_{5+} = 43,3 wt% C_4 = 18,1 wt% C_1 = 16,7 wt%	Double consecutive reactors: 1-Fe-Co-ZrO_2 2-SO_4^{2-}/ZrO_2	24
31	$(_{30}Fe_{70}Co_{1,81}S)/ZrO_2$	150°C	1 atm		5 h^{-1}	4.50%				C_{5+} = 33,3 wt C_4 = 19,1 wt% C_1 = 21,9 wt%	Double consecutive reactors: 1-Fe-Co-ZrO_2 2-SO_4^{2-}/ZrO_2	24
32	$(_{30}Fe_{70}Co_{1,94}S)/ZrO_2$	150°C	1 atm		5 h^{-1}	3.90%				C_{5+} = 28,5 wt% C_4 = 25,5 wt% C_1 = 20,8 wt%	Double consecutive reactors: 1-Fe-Co-ZrO_2 2-SO_4^{2-}/ZrO_2	24
33	$(_{30}Fe_{70}Co_{1,59}S)/ZrO_2$	150°C	1 atm		5 h^{-1}	4.30%				C_{5+} = 23,7 wt% C_4 = 31,6 wt% C_1 = 16,6 wt%	Double consecutive reactors: 1-Fe-Co-ZrO_2 2-SO_4^{2-}/ZrO_2	24

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Table 2: Catalyst testing details

Entry	Catalyst	Evaluation Conditions				Activity				Selectivity	Remarks	Reference
		Temperature	Pressure	H_2/CO	Flow rate/ Contact time	CO Conversion	Specific activity	TOF	TON			
34	$(_{30}Fe_{70}Co_{1,49}S)/ZrO_2$	150°C	1 atm		5 h^{-1}	4.00%				C_{5+} = 28,2 wt% C_4 = 27,3 wt% C_1 = 19,9 wt%	Double consecutive reactors: 1-Fe-Co-ZrO_2 2-SO_4^{2-}/ZrO_2	24
35	$(_{30}Fe_{70}Co_{1,29}S)/ZrO_2$	150°C	1 atm		5 h^{-1}	4.10%				C_{5+} = 36,0 wt% C_4 = 23,4 wt% C_1 = 17,6 wt%	Double consecutive reactors: 1-Fe-Co-ZrO_2 2-SO_4^{2-}/ZrO_2	24
36	4,94%Fe/HZSM-5	250°C	1 atm	1		3.00%				CO_2 = 28,7 % CH_n = 26,1 % C_1 = 44,9 % C_{5+} = 9,6 % $C_{5+}^{=}$ = 12,3 %		25
37	4.94%Fe/HY	250°C	1 atm	1		3.00%				CO_2 = 22,2 % CH_n = 24,9 % C_1 = 52,3 % C_{5+} = 17,5 % $C_{5+}^{=}$ = 0 %		25

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Table 2: Catalyst testing details

Entry	Catalyst	Evaluation Conditions				Activity				Selectivity	Remarks	Reference
		Temperature	Pressure	H_2/CO	Flow rate/ Contact time	CO Conversion	Specific activity	TOF	TON			
38	4,60%Co/HZSM-5	250°C	1 atm	1		3.00%				CO_2 = 10,0 % CH_n = 32,4 % C_1 = 52,0 % C_{5+} = 9,0 % $C_{5+}^{=}$ = 10,4 %		25
39	4,61%Co/HY	250°C	1 atm	1		3.00%				CO_2 = 6,4 % CH_n = 29,2 % C_1 = 57,1 % C_{5+} = 11,4 % $C_{5+}^{=}$ = 0 %		25
40	4.94%Fe/ZSM	250°C	1 atm	1		3.00%				CO_2 = 28,5 % CH_n = 28,8 % C_1 = 40,7 % C_{5+} = 9,7 % $C_{5+}^{=}$ = 16,4 %		25

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Table 2: Catalyst testing details

Entry	Catalyst	Evaluation Conditions				Activity				Selectivity	Remarks	Reference
		Temperature	Pressure	H_2/CO	Flow rate/ Contact time	CO Conversion	Specific activity	TOF	TON			
41	3%Fe/Y	250°C	1 atm	1		3.00%				CO_2 = 16,2 % CH_n = 28,4 % C_1 = 52,6 % C_{5+} = 6,8 % $C_{5+}^{=}$ = 0 %		25
42	4,86%($_{79}Fe_{21}Co$)/HZSM-5	250°C	1 atm	1		3.00%				CO_2 = 19,5 % CH_n = 27,9 % C_1 = 48,7 % C_{5+} =9,4 % $C_{5+}^{=}$ = 10,7 %		25
43	4,87%($_{79}Fe_{21}Co$)/HY	250°C	1 atm	1		3.00%				CO_2 = 25,4 % CH_n = 24,4 % C_1 = 51,4 % C_{5+} = 14,9 % $C_{5+}^{=}$ = 0 %		25

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Table 2: Catalyst testing details

Entry	Catalyst	Evaluation Conditions				Activity				Selectivity	Remarks	Reference
		Temperature	Pressure	H_2/CO	Flow rate/ Contact time	CO Conversion	Specific activity	TOF	TON			
53*	4,10%Co/carbon black	225°C	101 KPa	3		14.50%	1,25 μmol CO/(s g cat.)	4.21E-03		CH_n = 6,5 % C_1 = 91,6 %		9
54	3,20%($_{25}Fe_{75}Co$)/carbon black	225°C	101 KPa	3		4.40%	0.41	1.26E-03		CH_n = 6,6 % C_1 = 86,1 %		9
55	2,00%($_{27}Fe_{73}Co$)/carbon black	225°C	101 KPa	3		1.60%	0.12	9.18E-03		CH_n = 5,0 % C_1 = 92,1 %		9
56	1,70%($_{34}Fe_{66}Co$)/carbon black	225°C	101 KPa	3		1.60%	0.16	1.21E-03		CH_n = 5,4 % C_1 = 73,5 %		9
57	2,00%($_{56}Fe_{44}Co$)/carbon black	225°C	101 KPa	3		3.00%	0.22	4.06E-03		CH_n = 7,2 % C_1 = 84,4 %		9
58	4,40%Fe/carbon black	225°C	101 KPa	3		2.00%	0.11	2.10E-04		CH_n = 5,2 % C_1 = 44,2 %		9
75	4,20%($_{35,7}Fe_{35,7}Co_{28,6}K$/carbon black	275°C	101 KPa	3		4.50%	0.16	2.20E-03		CH_n = 3,3 % C_1 = 28,5 %		9
76	($_{50}Fe_{50}Co$)	250°C	0,69 MPa		139 μm/s	72.0%				C_1 = 21,85 % C_{5+} = 41,1		9

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Table 2: Catalyst testing details

Entry	Catalyst	Evaluation Conditions				Activity				Selectivity	Remarks	Reference
		Temperature	Pressure	H_2/CO	Flow rate/ Contact time	CO Conversion	Specific activity	TOF	TON			
77	$(_{50}Fe_{50}Co)$	260°C	0,69 MPa		139 μm/s	95.5%				C_1 = 23,1 % C_{5+} = 36,8 %		9
78	$(_{50}Fe_{50}Co)$	275°C	0,69 MPa		139 μm/s	97.5%				C_1 = 23,9% C_{5+} = 34,2 %		9
79	$10\%(_{50}Fe_{50}Co)/TiO_2$	220°C	10 bar	2	350 h^{-1}	34.2%	0.381		6.15E-02	C_1 = 13 % C_{2-4} = 12 % C_{5+} = 75 %	Run time = 200 h	9
80	$10\%(_{50}Fe_{50}Co_{0,08}K)/TiO_2$	220°C	10 bar	2	350 h^{-1}	38.8%	0.442		8.04E-02	C_1 = 9 % C_{2-4} = 10 % C_{5+} = 81 %	Run time = 200 h	9
81	$10\%(_{50}Fe_{50}Co_{0,47}K)/TiO_2$	220°C	10 bar	2	350 h^{-1}	28.7%	0.575		1.25E-01	C_1 = 10 % C_{2-4} = 19 % C_{5+} = 71 %	Run time = 200 h	9
82	$10\%(_{50}Fe_{50}Co_{1,13}K)/TiO_2$	220°C	10 bar	2	350 h^{-1}	25.8%	0.239		5.98E-02	C_1 = 8 % C_{2-4} = 12 % C_{5+} = 80 %	Run time = 200 h	9

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Table 2: Catalyst testing details

Entry	Catalyst	Evaluation Conditions				Activity				Selectivity	Remarks	Reference
		Temperature	Pressure	H_2/CO	Flow rate/ Contact time	CO Conversion	Specific activity	TOF	TON			
83	$10\%(_{50}Fe_{50}Co_{0,09}Cr)/TiO_2$	220°C	10 bar	2	350 h^{-1}	39.6%	0.481			C_1 = 11 % C_{2-4} = 12 % C_{5+} = 77 %	Run time = 200 h	9
84	$10\%(_{50}Fe_{50}Co_{0,6}Cr)/TiO_2$	220°C	10 bar	2	350 h^{-1}	37.4%	0.436		7.15E-02	C_1 = 9 % C_{2-4} = 9 % C_{5+} = 82 %	Run time = 200 h	13
85	$10\%(_{50}Fe_{50}Co_{1,04}Cr)/TiO_2$	220°C	10 bar	2	350 h^{-1}	31.4%	0.339		6.16E-02	C_1 = 11 % C_{2-4} = 13 % C_{5+} = 76 %	Run time = 200 h	13
86	$10\%(_{50}Fe_{50}Co_{0,07}Mn)/TiO_2$	220°C	10 bar	2	350 h^{-1}	32.3%	0.35		3.24E-02	C_1 = 10 % C_{2-4} = 14 % C_{5+} = 76 %	Run time = 200 h	13
87	$10\%(_{50}Fe_{50}Co_{0,45}Mn)/TiO_2$	220°C	10 bar	2	350 h^{-1}	31.6%	0.331		2.81E-02	C_1 = 9 % C_{2-4} = 12 % C_{5+} = 79 %	Run time = 200 h	13

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Table 2: Catalyst testing details

Entry	Catalyst	Evaluation Conditions				Activity				Selectivity	Remarks	Reference
		Temperature	Pressure	H_2/CO	Flow rate/ Contact time	CO Conversion	Specific activity	TOF	TON			
88	$10\%(_{50}Fe_{50}Co_{0,97}Mn)/TiO_2$	220°C	10 bar	2	350 h^{-1}	25.6%	0.242		2.78E-02	C_1 = 13 % C_{2-4} = 14 % C_{5+} = 72 %	Run time = 200 h	13
89	$10\%Fe/TiO_2$	220°C	10 bar	2	350 h^{-1}	11.40%	0.1		1.92E-02	C_1 = 27,2% C_{2-4} = 72,8 % C_{5+} = 0 %		13
90	$10\%(_{75}Fe_{25}Co)/TiO_2$	220°C	10 bar	2	350 h^{-1}	18.30%	0.17		1.55E-02	C_1 = 18,9 % C_{2-4} = 45,9 % C_{5+} = 34,7 %	Paraffin =68,5 % Olefin = 26,9 %	13
91	$10\%(_{50}Fe_{50}Co)/TiO_2$	220°C	10 bar	2	350 h^{-1}	36.30%	0.4		7.00E-02	C_1 = 11 % C_{2-4} = 14,6 % C_{5+} = 74,2 %	Paraffin =82,9 % Olefin = 15,8 %	13
92	$10\%(_{25}Fe_{75}Co)/TiO_2$	220°C	10 bar	2	350 h^{-1}	30.90%	0.34		3.74E-02	C_1 = 20,9 % C_{2-4} = 14,5 % C_{5+} = 64,2 %		13

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Table 2: Catalyst testing details

Entry	Catalyst	Evaluation Conditions				Activity				Selectivity	Remarks	Reference
		Temperature	Pressure	H_2/CO	Flow rate/ Contact time	CO Conversion	Specific activity	TOF	TON			
93	10%Co/TiO_2	220°C	10 bar	2	350 h^{-1}	63.90%	1.15		2.26E-01	C_1 = 14,4 % C_{2-4} = 9,3 % C_{5+} = 76,1 %		13
94	8%($_{50}Fe_{50}Co$)/TiO_2	220°C	10 bar	2	350 h^{-1}	30.80%	0.34		4.66E-02	C_1 = 11,4 % C_{2-4} = 14,5 % C_{5+} = 73,8 %		13
95	6%($_{50}Fe_{50}Co$)/TiO_2	220°C	10 bar	2	350 h^{-1}	25.40%	0.28		4.24E-02	C_1 = 10,5 % C_{2-4} = 12,6 % C_{5+} = 76,8 %		13
96	4%($_{50}Fe_{50}Co$)/TiO_2	220°C	10 bar	2	350 h^{-1}	15.80%	0.17		2.27E-02	C_1 = 11,0 % C_{2-4} = 14,1 % C_{5+} = 74,3 %		13
97	2%($_{50}Fe_{50}Co$)/TiO_2	220°C	10 bar	2	350 h^{-1}	10.50%	0.11		1.86E-02	C_1 = 9,0 % C_{2-4} = 19,5 % C_{5+} = 72,6 %		13

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Table 2: Catalyst testing details

Entry	Catalyst	Evaluation Conditions				Activity				Selectivity	Remarks	Reference
		Temperature	Pressure	H_2/CO	Flow rate/ Contact time	CO Conversion	Specific activity	TOF	TON			
98	10%($_{50}Fe_{50}Co$)/TiO_2	220°C	2 bar	2	350 h^{-1}	17.70%	0.131			C_1 = 16,7 % C_{2-4} = 26,6 % C_{5+} = 56,4 %	Paraffin =65,3 % Olefin = 33,5 %	13
99	10%($_{50}Fe_{50}Co$)/TiO_2	220°C	5 bar	2	350 h^{-1}	28.30%	0.278			C_1 = 19,1 % C_{2-4} = 28,3 % C_{5+} = 52,4 %	Paraffin =19,1 % Olefin = 28,3 %	13
100	10%($_{50}Fe_{50}Co$)/TiO_2	255°C	10 bar	2	350 h^{-1}	72.60%	0.964			C_1 = 41,6 % C_{2-4} = 24,3 % C_{5+} = 33,6 %	Paraffin =82,6 % Olefin = 16,6 %	13
101	10%($_{50}Fe_{50}Co$)/TiO_2	310°C	10 bar	2	350 h^{-1}	90.30%	1,014			C_1 = 52,4 % C_{2-4} = 29,1 % C_{5+} = 17,8 %	Paraffin =78,9 % Olefin = 20,0 %	13
102	10%($_{50}Fe_{50}Co$)/TiO_2	220°C	10 bar	2	1140 h^{-1}	15.90%	0.589			C_1 = 23,9 % C_{2-4} = 23,0 % C_{5+} = 52,7 %	Paraffin =57,8 % Olefin = 41,1 %	13

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Table 2: Catalyst testing details

Entry	Catalyst	Evaluation Conditions				Activity				Selectivity	Remarks	Reference
		Temperature	Pressure	H_2/CO	Flow rate/ Contact time	CO Conversion	Specific activity	TOF	TON			
103	$10\%(_{50}Fe_{50}Co)/TiO_2$	220°C	10 bar	2	500 h^{-1}	23.60%	0.378			C_1 = 24,4 % C_{2-4} = 25,2 % C_{5+} = 50,2 %	Paraffin =59,6 % Olefin = 39,7 %	13
104	$10\%(_{50}Fe_{50}Co)/TiO_2$	220°C	10 bar	1	350 h^{-1}	12.10%	0.167			C_1 = 13,2 % C_{2-4} = 28,4 % C_{5+} = 57,9 %	Paraffin =41,5 % Olefin = 57 %	13
105	$10\%(_{50}Fe_{50}Co)/TiO_2$	220°C	10 bar	0.5	350 h^{-1}	7.10%	0.125			C_1 = 8,6 % C_{2-4} = 19,6 % C_{5+} = 71,3 %	Paraffin =28,4 % Olefin = 70,1 %	13
106	$_{83}Fe_{17}Co$	300°C	0,1 Mpa	1	300 h^{-1}	26.00%				C_1 = 54,0 % O/P = 0,7		*
107	$_{77}Fe_{15}Co_8Mn$	300°C	0,1 Mpa	1	300 h^{-1}	53.10%				C_1 = 85,4 % O/P = 0,8		*
108	$_{71}Fe_{14,5}Co_{14,5}Mn$	300°C	0,1 Mpa	1	300 h^{-1}	60.00%				C_1 = 60,0 % O/P = 1,3		*

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Table 2: Catalyst testing details

Entry	Catalyst	Evaluation Conditions				Activity				Selectivity	Remarks	Reference
		Temperature	Pressure	H_2/CO	Flow rate/ Contact time	CO Conversion	Specific activity	TOF	TON			
109	$_{59}Fe_{12}Co_{29}Mn$	300°C	0,1 Mpa	1	300 h^{-1}	36.00%				C_1 = 76,7 % O/P = 0,7		*
110	$_{45}Fe_{10}Co_{45}Mn$	300°C	0,1 Mpa	1	300 h^{-1}	25.40%				C_1 = 81,8 % O/P = 0,6		*
111	7,9%($_{24}Fe_{76}Co$)/SiO_2	240°C	1 bar	1	500 h^{-1}	20.00%				C1 = 12,5 % C5+ = 71 %	:6 = 15 % High Olefine content (95%	18
112	7,9%($_{24}Fe_{76}Co$)/SiO_2	240°C	20 bar	1	500 h^{-1}					C1 = 32,4 % C5+ = 50 %	C5 = 11 % High Olefine content	18
113	7,9%($_{24}Fe_{76}Co$)/SiO_2	240°C	40 bar	1	500 h^{-1}	40.00%				C1 = 35,6 % C5+ = 33 %	C3 = 16 % High Olefine content	18
114	10%($_{50}Fe_{50}Co$)/TiO_2	270ºC	10 bar	2	350 h-1							48
115	10%Fe/TiO_2	270ºC	10 bar	2	350 h-1	15.80%	0.18		36	C1 = 9,3 % C5+ = 64,5 %		48
116	10%Co/TiO_2	270ºC	10 bar	2	350 h-1	22.50%	0.37		49.3	C1 = 7,8 % C5+ = 84,8 %		48

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Table 2: Catalyst testing details

Entry	Catalyst	Evaluation Conditions				Activity				Selectivity	Remarks	Reference
		Temperature	Pressure	H_2/CO	Flow rate/ Contact time	CO Conversion	Specific activity	TOF	TON			
117	20%($_{50}Fe_{50}Co$)/TiO_2	270ºC	10 bar	2	350 h-1	21.80%	0.33		71.7	C1 = 19,6 % C5+ = 49,1 %		48
118	20%($_{25}Fe_{75}Co$)/TiO_2	270ºC	10 bar	2	350 h-1	29.90%	0.55		-	C1 = 18,4 % C5+ = 67,7 %		48
119	10%($_{50}Fe_{50}Co$)/TiO_2	270ºC	10 bar	2	350 h-1	17.10%	0.24		44.4	C1 = 17,0 % C5+ = 69,5 %		48
120	15%($_{33}Fe_{67}Co$)/TiO_2	270ºC	10 bar	2	350 h-1	17.40%	0.27		-	C1 = 13,1 % C5+ = 70,3 %		48
121	15%($_{67}Fe_{33}Co$)/TiO_2	270ºC	10 bar	2	350 h-1	15.40%	0.2		-	C1 = 22,8 % C5+ = 44,2 %		48
122	10%Fe/TiO_2	220°C	10 bar	2	350 h-1	16.10%	0.13		43.3	C1 = 9,2 % C5+ = 66,2 %		48
123	10%Co/TiO_2	220°C	10 bar	2	350 h-1	67.40%	1.16		89.2	C1 = 15,6 % C5+ = 73,4 %		48

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Table 2: Catalyst testing details

Entry	Catalyst	Evaluation Conditions				Activity				Selectivity	Remarks	Reference
		Temperature	Pressure	H_2/CO	Flow rate/ Contact time	CO Conversion	Specific activity	TOF	TON			
124	10%($_{50}$Fe$_{50}$Co)/TiO_2	220°C	10 bar	2	350 h-1	36.20%	0.41		51.3	C1 = 9,8 % C5+ = 66,5 %		48
125	10%($_{50}$Fe$_{50}$Co)/TiO_2	220°C	10 bar	2	350 h-1	36.20%	0.35		83.3	C1 = 9,1 % C5+ = 81,2 %		48
126#	10%Co/SiO_2	230ºC	20 bar	2		28.00%				C1 = 22 % C5+ = 65 %		10
127	11%($_{9}$Fe$_{91}$Co)/SiO_2	230ºC	20 bar	2		11.00%				C1 = 23 % C5+ = 55 %		10
128	15%($_{33}$Fe$_{67}$Co)/SiO_2	230ºC	20 bar	2		10.00%				C1 = 35 % C5+ = 41 %		10
129	10,00%Co/CNT	220°C	2 MPa	2	30 mL/min	48.00%				C1 = 9,3 % C5+ = 85,1 %	Alcohols% = 2,3	35
130	10,5%($_{5}$Fe$_{95}$Co)/CNT	220°C	2 MPa	2	30 mL/min	54.00%				C1 = 9,4 % C5+ = 85 %	Alcohols% = 4,1	35
131	11%($_{9}$Fe$_{91}$Co)/CNT	220°C	2 MPa	2	30 mL/min	49.00%				C1 = 9,5 % C5+ = 83 %	Alcohols% = 5,4	35

Supporting Information
Bimetallic catalysts for the Fischer-Tropsch reaction

Table 2: Catalyst testing details

Entry	Catalyst	Evaluation Conditions				Activity				Selectivity	Remarks	Reference
		Temperature	Pressure	H_2/CO	Flow rate/ Contact time	CO Conversion	Specific activity	TOF	TON			
132	12%($_{17}$Fe$_{83}$Co)/CNT	220°C	2 MPa	2	30 mL/min	32.00%				C1 = 11,2 % C5+ = 78 %	Alcohols% = 22	35
133	14%($_{28}$Fe$_{72}$Co)/CNT	220°C	2 MPa	2	30 mL/min	30.00%				C1 = 12,3 % C5+ = 71 %	Alcohols% = 26,3	35
134	10%Fe/CNT	220°C	2 MPa	2	30 mL/min	10.00%				C1 = 16,9% C5+ = 46,7 %	Alcohols% = 10,3	35

*) S. L. Gonzales-Cortes, S. M. A. Rodulfo-Baechler, A. Oliveros, J. Orozco, B. Fontal, A. J. Mora, G. Delgado, *React. Kinet. Catal. Lett.* **2002**, 75, 3.

a) Incipient impregnation

b) Co-precipitation

c) Impregnation

d) Plasma sprying

e) Co-impregnation