

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property
Organization
International Bureau

(43) International Publication Date
23 May 2019 (23.05.2019)



(10) International Publication Number
WO 2019/099001 A1

(51) International Patent Classification:

C01B 3/40 (2006.01) *B01J 23/54* (2006.01)
B01J 23/38 (2006.01)

(21) International Application Number:

PCT/US2017/061783

(22) International Filing Date:

15 November 2017 (15.11.2017)

(25) Filing Language:

English

(26) Publication Language:

English

(71) Applicant: **GAS TECHNOLOGY INSTITUTE**
[US/US]; 1700 S. Mount Prospect Rd., Des Plaines, Illinois
60018 (US).

(72) Inventors: **MARKER, Terry L.**; 39 Country Squire Road,
Palos Heights, Illinois 60463-1251 (US). **LINCK, Martin**

B.; 13324 Promontory Trail, Roscoe, Illinois 61073 (US).
WANGEROW, Jim; 1140 Edmer Avenue, Oak Park, Illi-
nois 60302 (US). **ORTIZ-TORAL, Pedro**; 45 Laurel Trail,
Wheeling, Illinois 60090 (US).

(74) Agent: **SPEHLMANN, Benjamin C.**; 1100 13th Street,
Suite 1200, Washington, District of Columbia 20005 (US).

(81) Designated States (*unless otherwise indicated, for every
kind of national protection available*): AE, AG, AL, AM,
AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ,
CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO,
DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN,
HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP,
KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME,
MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ,
OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA,

(54) Title: NOBLE METAL CATALYSTS AND PROCESSES FOR REFORMING OF METHANE AND OTHER HYDROCAR-
BONS

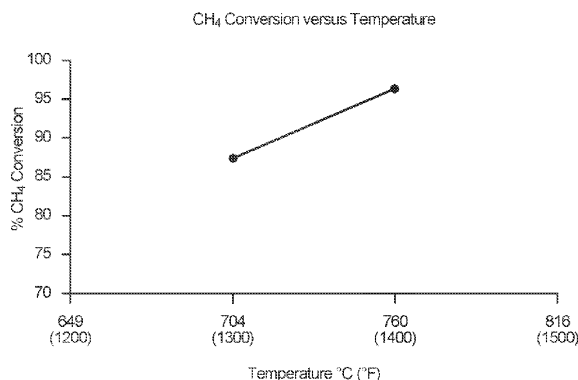


FIG. 2

(57) Abstract: Processes for converting methane and/or other hydrocarbons to synthesis gas (i.e., a gaseous mixture comprising H₂ and CO) are disclosed, in which at least a portion of the hydrocarbon(s) is reacted with CO₂. At least a second portion of the methane may be reacted with H₂O (steam), thereby improving overall thermodynamics of the process, in terms of reducing endothermicity (ΔH) and the required energy input, compared to "pure" dry reforming in which no H₂O is present. Catalysts for such processes advantageously possess high activity and thereby can achieve significant levels of methane conversion at temperatures below those used conventionally under comparable conditions. These catalysts also exhibit high sulfur tolerance, in addition to reduced rates of carbon (coke) formation, even in the processing (reforming) of heavier (e.g., naphtha boiling-range or jet fuel

[Continued on next page]

WO 2019/099001 A1

SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN,
TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— with international search report (Art. 21(3))

boiling-range) hydrocarbons. The robustness of the catalyst translates to high operating stability. A representative catalyst comprises 1 wt-% Pt and 1 wt-% Rh as noble metals, on a cerium oxide support.