

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

(19) World Intellectual Property
Organization
International Bureau

(43) International Publication Date
12 April 2018 (12.04.2018)



(10) International Publication Number
WO 2018/067464 A1

(51) International Patent Classification:
H01L 21/285 (2006.01) *H01L 21/02* (2006.01)
H01L 21/324 (2006.01)

(21) International Application Number:
PCT/US2017/054766

(22) International Filing Date:
02 October 2017 (02.10.2017)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
62/403,694 03 October 2016 (03.10.2016) US
15/718,412 28 September 2017 (28.09.2017) US

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(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,
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).

(54) Title: METHODS AND DEVICES USING PVD RUTHENIUM

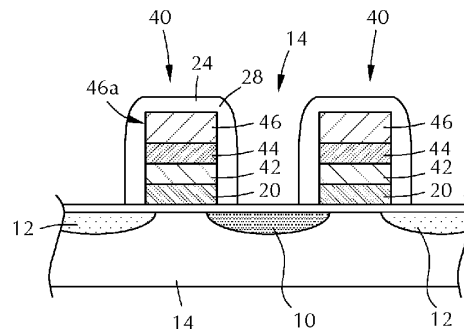


FIG. 1

(57) Abstract: Ruthenium containing gate stacks and methods of forming ruthenium containing gate stacks are described. The ruthenium containing gate stack comprises a polysilicon layer on a substrate; a silicide layer on the polysilicon layer; a barrier layer on the silicide layer; a ruthenium layer on the barrier layer; and a spacer layer comprising a nitride on sides of the ruthenium layer, wherein the ruthenium layer comprises substantially no ruthenium nitride after formation of the spacer layer. Forming the ruthenium layer comprises sputtering the ruthenium in a krypton environment on a high current electrostatic chuck comprising a high resistivity ceramic material. The sputtered ruthenium layer is annealed at a temperature greater than or equal to about 500 °C.

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Published:

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