

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
9 November 2006 (09.11.2006)

PCT

(10) International Publication Number
WO 2006/117621 A1

(51) International Patent Classification:
H01L 29/16 (2006.01) **H01L 21/04** (2006.01)

(74) Agent: **SPOOR & FISHER**; P.O. Box 454, 0001 Pretoria (ZA).

(21) International Application Number:
PCT/IB2006/001054

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(22) International Filing Date: 28 April 2006 (28.04.2006)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
0508889.3 29 April 2005 (29.04.2005) GB

(71) Applicant (for all designated States except US): **ELEMENT SIX LIMITED** [GB/GB]; Isle of Man Freeport, Ballasalla, Isle of Man IM99 6AQ (GB).

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

(71) Applicant (for MW only): **DONALD, Heather, June** [ZA/ZA]; Building No. 13, Highgrove Office Park, Oak Avenue, Centurion, 0001 Pretoria (ZA).

(72) Inventors; and

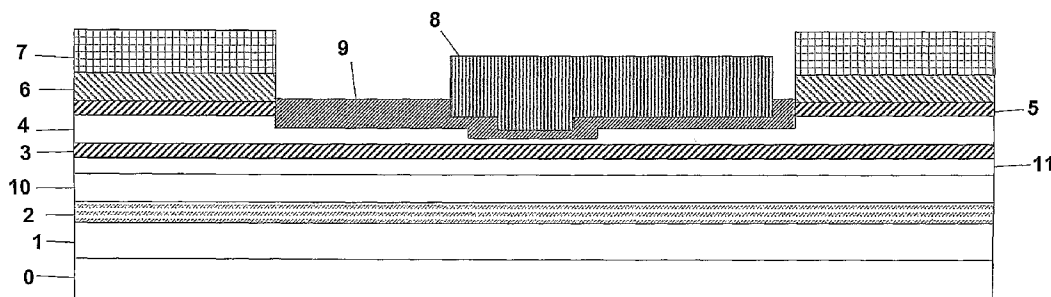
(75) Inventors/Applicants (for US only): **SCARSBROOK, Geoffrey, Alan** [GB/GB]; 40 Cavendish Mead, Sunninghill, Ascot Berkshire SL5 0BD (GB). **TWITCHEN, Daniel, James** [GB/GB]; 10 Park Drive, Sunningdale, Ascot Berkshire SL5 0BD (GB). **WORT, Christopher, John, Howard** [GB/GB]; 61 Upthorpe Drive, Wantage, Oxfordshire OX12 7DG (GB). **SCHWITTERS, Michael** [GB/GB]; 9 Poplar Close, Bracknell Berkshire RG12 9GD (GB). **KOHN, Erhard** [DE/DE]; Ratgebweg 21, 81089 Ulm (DE).

Published:

- with international search report
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: **DIAMOND TRANSISTOR AND METHOD OF MANUFACTURE THEREOF**



(57) Abstract: A method of manufacturing a transistor, typically a MESFET, includes providing a substrate comprising single crystal diamond material having a growth surface on which further layers of diamond material can be deposited. The substrate is preferably formed by a CVD process and has high purity. The growth surface has a root-mean-square roughness of 3nm or less, or is free of steps or protrusions larger than 3nm. Further diamond layers are deposited on the growth surface to define the active regions of the transistor. An optional n⁺shielding layer can be formed in or on the substrate, following which an additional layer of high purity diamond is deposited. In one embodiment of the method, a layer of intrinsic diamond is formed directly on the upper surface of the high purity layer, followed by a boron doped ("delta doped") layer. A trench is formed in the delta doped layer to define a gate region.

WO 2006/117621 A1