

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
27 September 2001 (27.09.2001)

PCT

(10) International Publication Number
WO 01/71734 A2

(51) International Patent Classification⁷: **H01F 10/32**,
41/30

(21) International Application Number: PCT/US01/08987

(22) International Filing Date: 21 March 2001 (21.03.2001)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
09/532,572 22 March 2000 (22.03.2000) US

(71) Applicant: **MOTOROLA, INC.** [US/US]; 1303 East Algonquin Road, Schaumburg, IL 60196 (US).

(72) Inventor: **SLAUGHTER, Jon**; 9251 South Kenneth Place, Tempe, AZ 85284 (US).

(74) Agents: **INGRASSIA, Vincent, B.** et al.; P.O. Box 10219, Scottsdale, AZ 85271-0219 (US).

(81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW.

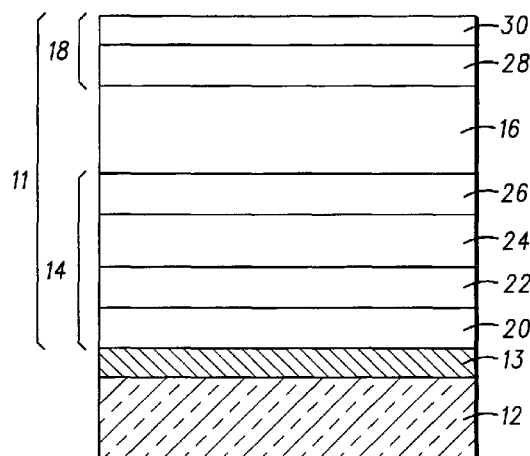
(84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:

— without international search report and to be republished upon receipt of that report

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: MULTI-LAYER TUNNELING DEVICE WITH A GRADED STOICHIOMETRY INSULATING LAYER



(57) Abstract: An improved and novel multi-layer thin film device including a graded-stoichiometry insulating layer (16) and a method of fabricating a multi-layer thin film device including a graded-stoichiometry insulating layer (16). The device structure includes a substrate (12), a first electrode (14), a second electrode (18), and a graded-stoichiometry insulating, or tunnel-barrier, layer (16) formed between the first electrode (14) and the second electrode (18). The graded-stoichiometry insulating tunnel-barrier layer (16) includes graded stoichiometry to compensate for thickness profile and thereby produce a uniform tunnel-barrier resistance across the structure (10). In addition, included is a method of fabricating a multi-layer thin film device (10) including a graded-stoichiometry insulating tunnel-barrier layer (16) including the steps of providing (40) a substrate (12), depositing (44) a first electrode (14) on the substrate (12), depositing (46) a metal layer (21) on a surface of the first electrode (14), reacting (50; 52; or 54) the metal layer (21) to form an insulating tunnel-barrier layer with uniform tunneling resistance (16) by using a non-uniform reaction process (21) and depositing (56) a second electrode (18) on the uniform tunneling insulating layer (16).