(12) UK Patent Application (19) GB (11) 2493463 (13) A

(43) Date of Reproduction by UK Office **06.02.2013**

(21) Application No: **1214280.8**

(22) Date of Filing: **18.05.2011**

Date Lodged: **10.08.2012**

(30) Priority Data:
(31) **12792242** (32) **02.06.2010** (33) **US**

(86) International Application Data:
PCT/EP2011/058086 En 18.05.2011

(87) International Publication Data:
WO2011/151183 En 08.12.2011

(71) Applicant(s):
International Business Machines Corporation
(Incorporated in USA - New York)
New Orchard Road, Armonk, New York 10504,
United States of America

(72) Inventor(s):
Dechao Guo
Philip Oldiges
Tze-Chiang Chen
Yanfeng Wang

(74) Agent and/or Address for Service:
IBM United Kingdom Limited
Intellectual Property Law, Hursley Park,
WINCHESTER, Hampshire, SO21 2JN,
United Kingdom

(51) INT CL:
H01L 29/51 (2006.01) ***H01L 21/28*** (2006.01)
H01L 29/49 (2006.01)

(56) Documents Cited by ISA:
WO 2010/047013 A1 **US 20100148280 A1**
WANG X P et al: " Physical and electrical characteristics of high-kappa gate dielectric Hf(1-x) Lax0y", SOLID STATE ELECTRONICS, Vol 50, No 6, 1st June 2006 pg 986-991, Elsevier, GB, ISSN:0038-1101 (XP025127628)

(58) Field of Search by ISA:
INT CL **H01L**
Other: **EPO-Internal, INSPEC**

(54) Title of the Invention: **High-K metal gate stack**
Abstract Title: **High-K metal gate stack**

(57) A gate stack structure for field effect transistor (FET) devices includes a nitrogen rich first dielectric layer formed over a semiconductor substrate surface; a nitrogen deficient, oxygen rich second dielectric layer formed on the nitrogen rich first dielectric layer, the first and second dielectric layers forming, in combination, a bi-layer interfacial layer; a high-k dielectric layer formed over the bi-layer interfacial layer; a metal gate conductor layer formed over the high-k dielectric layer; and a work function adjusting dopant species diffused within the high-k dielectric layer and within the nitrogen deficient, oxygen rich second dielectric layer, and wherein the nitrogen rich first dielectric layer serves to separate the work function adjusting dopant species from the semiconductor substrate surface.

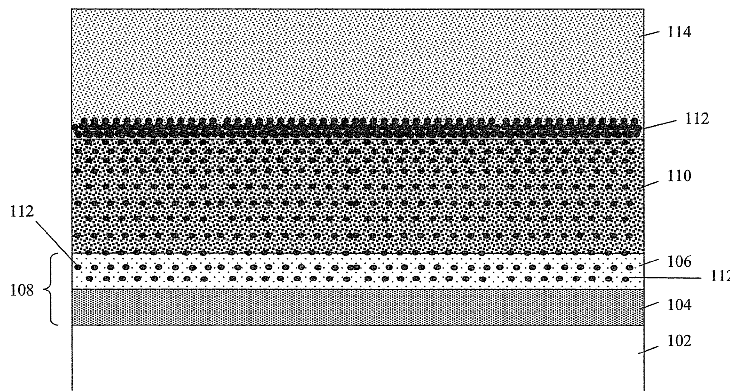

Figure 1(f)

GB 2493463 A