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(54) **METHOD FOR FORMING A FIELD EFFECT TRANSISTOR HAVING A HIGH-K GATE DIELECTRIC AND RELATED STRUCTURE**

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(51) **Int. Cl.**⁷ **H01L 21/8242**

(52) **U.S. Cl.** **438/287; 438/240; 438/591; 438/785**

(58) **Field of Search** **438/287, 240, 438/591, 785**

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,703,277 B1 * 3/2004 Paton et al. 438/287

* cited by examiner

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(57) **ABSTRACT**

According to one exemplary embodiment, a method for forming a field effect transistor over a substrate comprises a step of forming an interfacial oxide layer over a channel region of the substrate, where the interfacial oxide layer has a first thickness. The interfacial oxide layer can prevent a high-k element from diffusing into the channel region. The method further comprises forming an oxygen-attracting layer over the interfacial oxide layer, where the oxygen-attracting layer prevents the first thickness of the interfacial oxide layer from increasing. The oxygen-attracting layer is formed by forming a metal layer over the interfacial oxide layer, where the metal layer combines with oxygen to form a silicate. The oxygen-attracting layer may be zirconium silicate or hafnium silicate, for example. The method further comprises forming a high-k dielectric layer over the oxygen-attracting layer. The method further comprises forming a gate electrode layer over the high-k dielectric layer.

7 Claims, 4 Drawing Sheets

