METHODS FOR EFFECTIVE NICKEL SILICIDE FORMATION

ABSTRACT

Methods for forming a high quality nickel silicide film in the fabrication of an integrated circuit are described. A semiconductor substrate is provided having silicon regions to be silicided wherein a native oxide layer forms on the silicon regions. A nickel layer is deposited overlying the silicon regions to be silicided. A titanium layer is deposited overlying the nickel layer. The substrate is annealed whereby titanium atoms from the titanium layer diffuse through the nickel layer and react with the native oxide layer and whereby the nickel is transformed to nickel silicide where it overlies the silicon regions and wherein the nickel not overlying the silicon regions is unreacted. In an alternative method, a titanium nitride layer over the titanium layer traps atmospheric oxygen freeing all of the titanium in the titanium layer to react with the underlying native oxide. The unreacted nickel layer is removed to complete formation of a nickel silicide film in the manufacture of an integrated circuit. In another method, a monolayer of titanium is deposited by atomic layer chemical vapor deposition underlying the nickel layer. The substrate is annealed whereby titanium atoms from the titanium monolayer react with the native oxide layer and whereby the the nickel is transformed to nickel silicide.

(FIGURE 1)

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