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## (54) METHODS FOR FABRICATING MAGNETORESISTIVE RANDOM ACCESS **MEMORY**

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(57)ABSTRACT

Methods for fabricating a magnetoresistive random access memory are disclosed. In this method, an MTJ stack is formed over a lower metal layer on a semiconductor substrate, and a first etching is then performed to form an MTJ component and to expose a portion of a bottom electrode layer or via beneath the MTJ stack. An oxidation process is then carried out to oxidize both a conductive redeposition on sidewalls of the MTJ component and a partial thickness of the exposed portion of the bottom electrode layer or via around the MTJ component. Subsequently, a second etching is conducted at an incident etching angle of smaller than 45°, which facilitates complete removal of the resulting sidewall oxide layer on the MTJ component, as well as damaged portions thereof which may degrade the performance of the MTJ component, ensuring reliability of the MTJ component.

forming a first dielectric layer over a lower metal layer on a semiconductor substrate; forming a via extending through the first dielectric layer and a bottom electrode material layer filling the via and covering the first dielectric layer, wherein the bottom electrode material layer is connected to the lower metal layer through the via

forming a magnetic tunnel junction (MTJ) stack on the bottom electrode material layer

performing a first etching on the MTJ stack to form an MTJ device aligned with the via and to expose a portion of the bottom electrode material layer around the MTJ device, wherein a conductive redeposition is formed on sidewalls of the MTJ device during the first etching

performing an oxidation process to form a sidewall oxide layer on each sidewall of the MTJ device by oxidizing the conductive redeposition and to form a bottom oxide layer around the MTJ device by oxidizing the exposed portion of the bottom electrode material layer around the MTJ device, wherein a portion of the bottom electrode material layer that is not oxidized and located beneath the MTJ device and the bottom oxide layer serves as a bottom electrode

removing the sidewall oxide layer by a second etching, wherein the second etching is performed at an etching angle of smaller than 45°