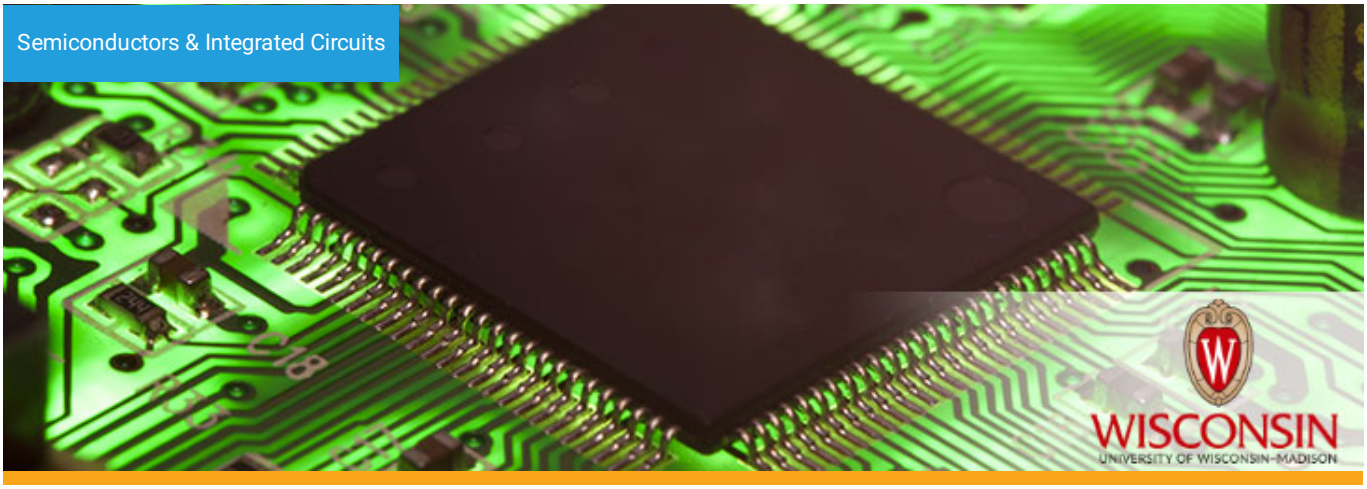

Fabrication of Oxide Barriers Using Selective Oxidation of Metallic Thin Films

View U.S. Patent No. 7,579,042 in PDF format.

WARF: P04250US

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The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a method to completely and selectively oxidize only the tunnel barrier layer in magnetic tunnel junctions.

Overview

Tunneling magneto-resistive (TMR) read heads are the next generation in magneto-resistive readers for hard drive disks. TMRs typically include a magnetic tunnel junction that is composed of an oxidized, insulating layer, known as a tunnel barrier layer, sandwiched between two ferromagnetic layers.

The quality of this junction is critical to the performance of the TMR. This means that the insulating tunnel barrier layer must be completely oxidized while the top and bottom ferromagnetic layers remain completely un-oxidized. In practice, however, selectively oxidizing the middle layer without also oxidizing the neighboring ferromagnetic layers has been hard to do.

The Invention

UW-Madison researchers have now demonstrated that by performing the oxidation step under an atmosphere composed only of CO and CO_2 gases, they can completely and selectively oxidize only the tunnel barrier layer in magnetic tunnel junctions. A CO/CO_2 gas mixture provides a much lower partial pressure of oxygen than can be achieved when pure oxygen is used as the oxidizing gas.

By tuning the CO/CO_2 gas ratio, the researchers easily oxidized a tunnel barrier layer made of aluminum without oxidizing neighboring ferromagnetic layers composed of a cobalt/iron alloy. In essence, the method works because some materials, such as aluminum, will oxidize easily under very low partial pressures of oxygen, while others, such as cobalt, will not.

Applications

- Creates magnetic tunnel junctions well suited for use in a variety of magnetic sensor and storage devices, including tunneling magneto-resistive (TMR) read heads and magnetic random access memory (MRAM)

Key Benefits

- Avoids under-oxidation of tunnel barrier layers seen in other methods for fabricating magnetic tunnel junctions
- Can be used to selectively oxidize a host of other metals with a propensity to form oxides, including yttrium, hafnium, tantalum, zirconium and niobium

Tech Fields

For current licensing status, please contact Emily Bauer at emily@warf.org or 608-960-9842