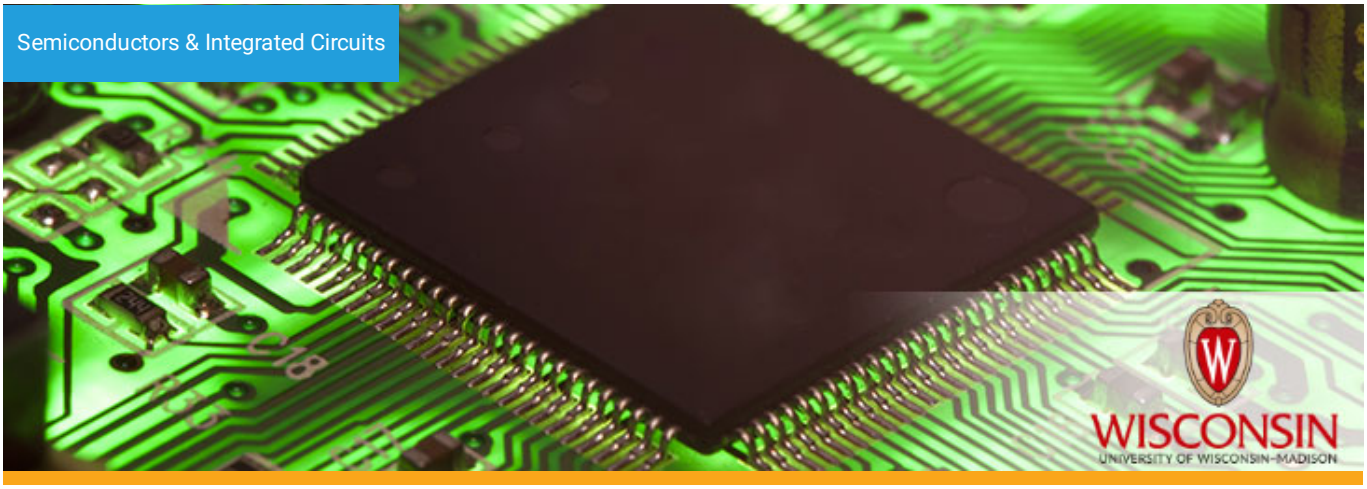

Vanadium Dioxide Design Solution for Ultrafast Switches

View U.S. Patent No. 11,335,781 in PDF format.

WARF: P170254US01

Inventors: Chang-Beom Eom, Daesu Lee

The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing vanadium dioxide-based switches characterized by isostructural metal-insulator transition near room temperature.

This technology overcomes a longstanding challenge and potentially enables devices with unprecedented speed and endurance.

Overview

The unique properties of vanadium dioxide (VO_2) mean it could one day outperform silicon and enable next-generation, ultralow-power devices. A key advantage of this material is that above 341 kelvin – near room temperature – bulk VO_2 is a metal. But as soon as the material is cooled below 341 k, VO_2 turns into an insulator. The superfast change in resistance means that VO_2 could be very powerful in a variety of applications involving high speed optoelectronic switches.

However, the metal-insulator transition is accompanied by an undesirable change in crystal structure from rutile to monoclinic, which to date has limited the material's practical applications.

The Invention

UW–Madison researchers have designed VO_2 heterostructures capable of metal-insulator transition near room temperature in practical thin films. The heterostructures are made of multiple bilayers of $V0_2$ engineered to have different rutile-to-monoclinic structural transition temperatures.

The bilayers can be incorporated into a variety of electrical switches including capacitors, planar switches and field effect switches, in integrated circuits for memory devices (e.g., CMOS chips) and communication devices. In each of these devices the conversion of the bilayer from its electrically insulating to conducting metallic state (and vice versa) changes the resistance/conductance of the bilayer, thereby modulating current flow or capacitance.

Applications

- Optoelectronic switches, Mott transistors, femtosecond switches and more

Key Benefits

- Maximizes the potential of $V0_2$ as a next-generation material

Stage of Development

The development of this technology was supported by WARF Accelerator. WARF Accelerator selects WARF's most commercially promising technologies and provides expert assistance and funding to enable achievement of commercially significant milestones.

WARF believes that these technologies are especially attractive opportunities for licensing.

Additional Information

For More Information About the Inventors

- Chang-Beom Eom

Related Technologies

- Find more thin-film innovations developed by Prof. Chang-Beom Eom

Publications

- Lee D. et al. 2018. Isostructural Metal-Insulator Transition in VO2. Science 6418, 1037-1040.
- Read a news story about this technology.

Tech Fields

- Semiconductors & Integrated Circuits : Components & materials
- Semiconductors & Integrated Circuits : Other semiconductor technologies

For current licensing status, please contact Michael Carey at mcarey@warf.org or 608-960-9867