Development of diamond bipolar transistor

Low loss power device contributing to a sustainable society

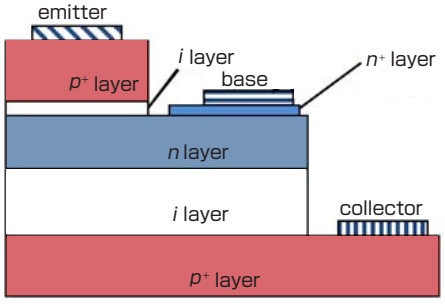
We have developed a diamond bipolar transistor with a current amplification ratio of around 10 under the condition of the common-emitter configuration. The transistor consists of heavily phosphorus doped n-type and heavily boron doped p-type diamond layers in addition to well-controlled n-type and intrinsic diamond layers. This success has been achieved by the introduction of the low resistive n-type layer and the low contact resistance between metal and the n-type layer.

Satoshi YAMASAKI

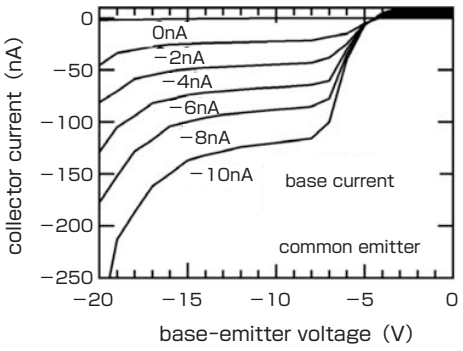
Energy Technology Research Institute

s-yamasaki@aist.go.jp

AIST TODAY Vol.12 No.2 p.14 (2012)



Structure of diamond bipolar transistor



Electrical transport properties of diamond power device
Collector current is amplified to around 10 times of base current.

Development of positive electrode materials for low-cost and high-performance rechargeable lithium-ion batteries

Co- and Ni-free and high capacity positive electrode materials

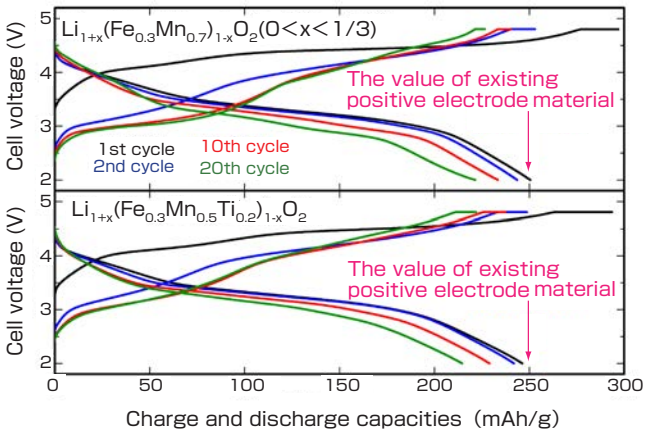
New oxide materials for the positive electrode consisting of lithium, iron, titanium, and manganese ($Li_{1+x}(Fe_{0.3}Mn_{0.7})_{1-x}O_2$ and $Li_{1+x}(Fe_{0.3}Mn_{0.5}Ti_{0.2})_{1-x}O_2$, $0<x<1/3$) are developed by a wet chemical method including carbothermal reduction process. These materials do not contain rare metals, cobalt and nickel, and have favorable battery characteristics (about 250 mAh/g of initial discharge capacity and above 80 % of initial cycle efficiency) in the same potential range (2.0-4.8 V) as that of conventional positive electrodes ($Li_{1.2}Co_{0.13}Ni_{0.13}Mn_{0.54}O_2$) . This development offers a high prospect for conserving resources and reducing the cost of rechargeable lithium-ion batteries used in electric vehicles by utilizing iron and titanium.

Mitsuharu TABUCHI

Research Institute for Ubiquitous Energy Devices

m-tabuchi@aist.go.jp

AIST TODAY Vol.12 No.3 p.12 (2012)



Comparison of charge and discharge cycle characteristics of two types of newly developed positive electrode material for up to 20 cycles at 30 ℃
Metallic lithium is used as the negative electrode material. (potential range: 2.0 V to 4.8 V)