TECHNICAL SESSIONS

June 15, 2013

15:20-17:00

Session 13: Novel Materials & Process II
Session Co-chairs:
Zsolt Tokei, IMEC
Andreas Klipp, BASF Electronic Materials

15:20-15:45

13-1 ***Graphene Interconencts Selectively Grown on Catalytic Metal Damascene Structure and its Growth Mechanism on Ni Catalyst***

Makoto Wada, Taishi Ishikura, Daisuke Nishide, Ban Ito, Yuichi Yamazaki, Tatsuro Saito, Atsunobu Isobayashi, Munehito Kagaya, Takashi Matsumoto, Masayuki Kitamura, Atsuko Sakata, Masahito Watanabe, Naoshi Sakuma, Akihiro Kajita, Tadashi Sakai
Low-power Electronics Association and Project (LEAP), Japan

<*Abstract*>
The present work investigated the possibility of the formation of graphene interconnects and studied the behavior of graphene growth in wiring structure. Graphene nucleated on the facet of catalytic metal, and multi layer graphene grew along the terrace surface of catalytic metal. Selective graphene growth served the stacked interconnects structure of graphene / Ni catalytic metal. Reducing surface roughness and controlling graphene growth condition are important to achieve large quantities and high continuity graphene growth.

15:45-16:10

13-2 ***Intercalated Multi-Layer graphene Grown by CVD for LSI Interconnects***

Daiyu Kondo, Haruhisa Nakano, Bo Zhou, Ichiro Kubota, Kenjiro Hayashi, Katsunori Yagi, Makoto Takahashi, Motonobu Sato, Shintaro Sato, Naoki Yokoyama
Collaborative Research Team Green Nanoelectronics Center (GNC),AIST, Japan

<*Abstract*>
We have fabricated multi-layer graphene (MLG) wiring and demonstrated a resistivity of the same order as Cu and reliability better than Cu. The MLG was synthesized epitaxially by chemical vapor deposition (CVD) on an epitaxial Co film, resulting in quality and electrical properties as good as those of a graphite crystal. The MLG was further intercalated with FeCl3 to achieve a resistivity as low as 9.1 *f*Ê*f*¶cm. Our results show that intercalated MLG is really promising for future LSI interconnects.

16:10-16:35

13-3 ***Electrical Improvement of CNT Contacts with Cu Damascene Top Metallization***

Marleen van der Veen{1}, Yohan Barbarin{1}, Bart Vereecke{1}, Masahito Sugiura{2}, Yusaku Kashiwagi{2}, Daire Cott{1}, Cedric Huyghebaert{1}, Zsolt Tökei{1}
{1}imec, Belgium; {2}Tokyo Electron Ltd., Japan

<*Abstract*>
We discuss the improvement in the electrical characterization and the performance of 150 nm diameter contacts filled with carbon nanotubes (CNT) and a Cu damascene top metal on 200mm wafers. The excellent agreement between the yield curves for the parallel and single contacts shows that a reliable electrical characterization is obtained. We demonstrate that integration changes improved

the resistivity of the CNT contact significantly by reducing it from $11.8 \cdot 10^3$ μΩ·cm down to $5.1 \cdot 10^3$ μΩ·cm. Finally, a length scaling of the CNT contacts was used to find the individual contributors to the lowering of the single CNT contact resistance.

16:35-17:00

13-4 ***Carbon Nanotube vias Fabricated at Back-End of Line Compatible Temperature Using a Novel CoAl Catalyst***

Sten Vollebregt, Hugo Schellevis, Kees Beenakker, Ryoichi Ishihara
Delft University of Technology, Netherlands

<Abstract>
Vertically aligned carbon nanotubes (CNT) were fabricated using a novel CoAl catalyst at substrate temperatures as low as 350 C and analysed using Raman spectroscopy. Electrical measurement structures were fabricated and characterized using CNT bundles grown at 400 C. The resulting I-V characteristics display a slight non-linearity, likely due to a non-optimal top contact. The first measurement results indicate CoAl can be an attractive candidate for back-end integration of CNT.