

NANO-RESISTORS BASED DEVICES – EFFECTS OF SIZE AND STRUCTURE ON PERFORMANCE

Yue Kuo, Texas A&M University
yuekuo@tamu.edu

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Recently, a new type of nano-resistor device that can emit the broad band white light as well as show the diode-like behavior has been reported (1,2,3). They are potentially applicable to lighting, on-chip interconnects, nonvolatile memories, nano-heaters, etc. The nano-resistor device can be operated continuously for more than 20,000 hours in air without a passivation layer. The unique phenomenon of simultaneous formation of a large number of nm-sized nano-resistors from the breakdown of a MOS capacitor was never reported in the open literature until our publication.

In this paper, new results on nano-resistor devices will be discussed. The device size effect on the light emission phenomenon, as shown in Fig. 1, will be explained from the distribution of nano-resistors across the gate electrode and the nano-resistor formation mechanism. In addition, the increase of the light emission efficiency from the embedding of nanocrystals in the gate dielectric layer will be discussed based on defects enhanced nano-resistors formation process. Furthermore, for the large array application, the crosstalk among adjacent devices can be avoided using the coplanar structure, which will be shown in this paper. The device performance will be compared with that of the vertical-structured device.

In summary, nano-resistor devices are easily fabricated with IC compatible materials and processes. They are medium power devices complementary to IC as well as other electronics and optoelectronics.

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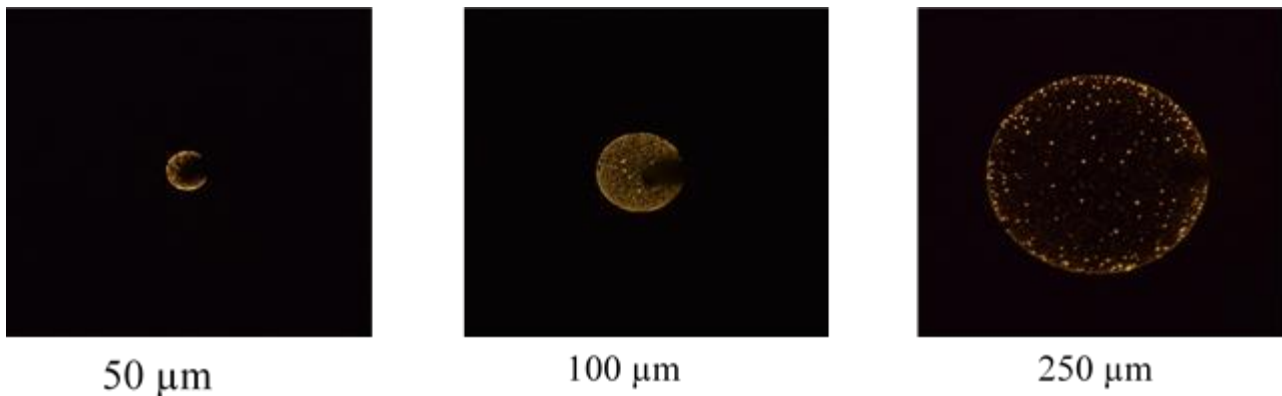


Figure 1. Nano-resistor devices of different diameters