XXXII Panhellenic Conference on Solid State Physics and Materials Science
Conference Center "Carolos Papoulias", 18-21 September 2016, Ioannina, Greece

Laser fabrication of a hybrid platform combining electrical and optical interconnects

S. Papazoglou[1], M. Makrygianni[1], F. Zacharatos[1], M. K. Filippidou[2], S. Chatzandroulis[2], and I. Zergioti[1]

1. National Technical University of Athens, Physics Department, Heroon Polytehneiou 9, 15780, Zografou, Greece

2. Institute of Nanoscience and Nanotechnology, NCSR Demokritos, Agia Paraskevi, Greece, 153 10.

Abstract:

With the evolution of flexible and stretchable devices during the last decade, the need for highly integrated components in multi-functional systems is now more urgent than ever. Furthermore, fabrication cost and process yield is of utter importance, while at the same time robustness and reliability are factors that need to be addressed in modern integrated circuits. In this work we report on a Polyimide (PI) based flexible platform, on which both electrical and optical interconnects are integrated by employing laser processing. Silver and copper nanoparticle inks and nanopastes were used to form highly conductive conformal interconnects for several types of multilevel devices residing on the PI substrate, by means of Laser Induced Forward Transfer technique (LIFT) and selective laser sintering. In particular, we have demonstrated the fabrication of electrical interconnects for the wire bonding of an all-laser printed resistive gas sensor device consisting of reduced graphene oxide as sensing element, with a printed circuit board (PCB). The aforementioned sensors were electrically characterized exhibiting good response upon the flow of humidity vapours (for humidity concentrations as low as 500ppm), with distinct resistance variations, avoiding cross-talk between adjacent sensors. On the same die, we have also applied selective laser curing for the direct writing of multi-mode optical waveguides operating at 1550 nm, and performed optical characterization in terms of performance, attenuation and reliability. These optical waveguides are of interest for short-distance optical interconnects which are key enablers for high-performance optoelectronic systems and can be particularly used as high speed optical interconnects for active optical components such as VCSELs and LEDs bonded on flexible substrates.