Integration of Organic and Organic/Inorganic based junctions for non volatile crossbar memory applications by standard UV lithography

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Cross-bar architectures for non-volatile memories are searched in order to enable the 3D stacking thus pushing bit densities beyond the limitation imposed by the lithography. Following this approach the bit storage and selection elements are stacked vertically at the cross point between two perpendicular electrodes lying on two parallel planes and are therefore manufactured both in the Back end Of Line. Considering the fact that silicon is not well suited, due to the high thermal budget required, different materials are currently explored. Organic materials are promising candidates for the selection element. This class of materials presents several advantages such as the low fabrication cost and the low thermal budget requirement. On the other hand, the integration of the polymers into microelectronic devices is a challenging task, because the standard processes used in device fabrication, most notably photolithography, are not fully compatible with such materials. Therefore a method for a non destructive patterning should be developed.

In this study, developed in the framework of the EU project VERSATILE, a possible route for integration of small size organic Schottky diodes in a crossbar architecture by standard UV lithography, is proposed and discussed. The electrical characteristics of the as prepared junctions revealed the successful patterning of the materials and demonstrate the compatibility of the process sequence steps with the tested compounds.

In parallel, by applying the proposed integration route, hybrid p-n junctions were built between different synthesized organic compounds and ZnO. The ZnO was grown by Atomic Layer Deposition technique under low temperature conditions (100^{o}C). The prepared hybrid devices revealed very good electrical characteristics with a rectification ratio over 10^5. A remarkable feature is the high current density that was obtained, nearly 10^4 A/cm^2 at 4V. These results are very promising for successful future applications of this combination of materials in microelectronic industry.