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New approach for nanowires fabrication for integration in sensor applications

4. Micro-and Nanoelectronics

The use of nanostructures, like nanowires, in today sensors and electronic devices is one major solution for extending the performances and application areas of these devices.

Various nanostructures already been used in fabrication of sensors and other electronic devices [1], but many applications could benefit from using different types of nanowires. The integration of nanostructures like nanowires in today available electronic devices and sensors is often a difficult task because in most of cases it is rather difficult to control the position and orientation of fabricated nanowires.

Here we propose a simple method to fabricate nanostructures. We have used a thin polymer film in which preferential cracking was induced, creating a template for fabrication of nanowires. We have recently demonstrated [2] that thin film fracture can serve as a template for fabrication of well aligned nanowires.

This approach can be used to integrate nanowires into a conventional silicon microstructure because the position and orientation of nanocracks is controled by using a patterned polymer thin film, designed in such way that the fracture position and direction is given by the shape of patterns in the polymer film. Such pattern can be fabricated using e-beam lithography or even conventional lithography. E-beam lithography offers a better control over the shape of patterns, specifically on controling the radius of the pattern at the starting point of fracture. In fig. 1a is shown a possible pattern for this approach fabricated on PMMA, where the breaking point of such structure is at the sharp tip of the pattern.

The fracture of the film is induced by cooling the sample in liquid nitrogen which creates a strong stress in the polymer film, leading to aparition of a nanocrack, needed for fabrication nanowires. The application of stress will create a fracture in the weakest point

of the structure, in this case between the two tips of a pair of patterns. In fig. 1b are shown similar patterns fabricated in PMMA and nanocracks between them obtained after stressing the polymer film.

Metal deposition and mask lift-off leads to creation of nanowires connected between two microscale contacts. This simple geometry can serve already as a fully developed device, for example a transistor or a nano electromechanical resonator. Depending on the material used for deposition is possible to fabricate different nanostructures integrated with devices fabricated using standard silicon technology.

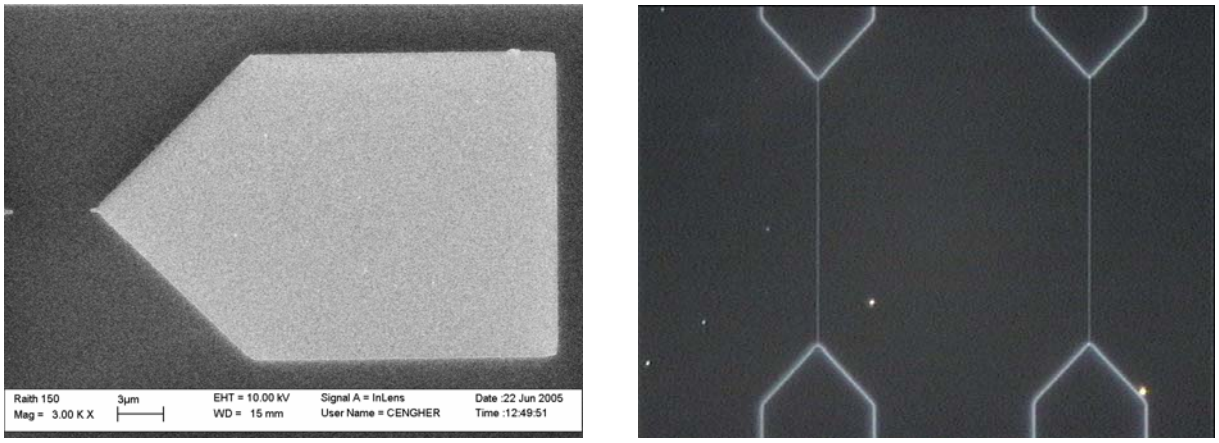

Fig 1. a)Patterns fabricated in polymer using e-beam lithography and b) patterns after fabricating nanocracks

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