

He- induced nanocavities for the gettering of metallic impurities in silicon

E. Ntsoenzok<sup>1</sup>, R. Delamare<sup>1</sup>, D. Alquier<sup>2</sup>,  
C.L. Liu<sup>1,2</sup>, S. Ashok<sup>3</sup>

<sup>1</sup> CERI-CNRS, 3A rue de la Férollerie, 45071 Orléans  
CEDEX, France

<sup>2</sup> LMP, 16 rue Pierre et Marie Curie, BP 7155, F37071 Tours  
CEDEX, France

<sup>3</sup> Department of Engineering Science and Mechanics, the  
Pennsylvania State University, 212 Earth and Engineering  
Science Building, University Park, PA 16802, USA

Nanocavities are very efficient gettering sites for unwanted metallic impurities in silicon. They allow a new approach, proximity gettering, which is more compatible with evolution of semiconductor technology. Compared to conventional internal gettering, the trapping site by implantation can be situated just near the active area of the device. They also provide the way to trap impurities even at the concentration lower than the solubility limit. That is not possible with classical internal gettering procedure. Then the trapping of metallic impurities by these nano-objects might become the most efficient way to obtain a high purity silicon.

However, there is still a lot of investigations in order to optimise their formation and their cost. This work is a fundamental approach where nanocavities are studied as a function of implantation depth and where additional hydrogen is provided by plasma treatment. We implanted at 100 nm (10keV), 400 nm (50 keV) and 5700 nm (1,55 MeV) with helium ion at different doses. The last energy might result in a conservative growth of cavities. Regarding the implantation depth, the most important result is that there is no faceting of cavities for the lowest depth while a clear faceting is observed for the higher depths (Fig. 1). Also, the volume occupied by the cavities is higher with helium energy at a giving dose. The plasma treatment mainly results in the trapping of hydrogen by the cavities and then exhibit a quite unexpected growth (Fig. 2).

Presenting Author:

E. Ntsoenzok, CERI-CNRS, 3A rue de la Férollerie, 45071  
Orléans CEDEX, France

Email : [esidor@cns-orleans.fr](mailto:esidor@cns-orleans.fr)

Tel : (33) 2 38 76 40 63

Fax : (33) 2 38 63 02 71

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Fig. 1: Evolution of cavities as a function of He energy: 10 keV (upper), 50 keV (middle), 1.55 MeV (bottom)

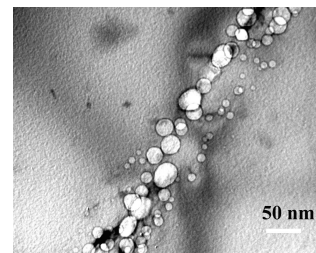
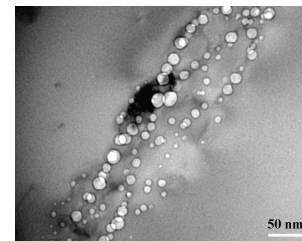
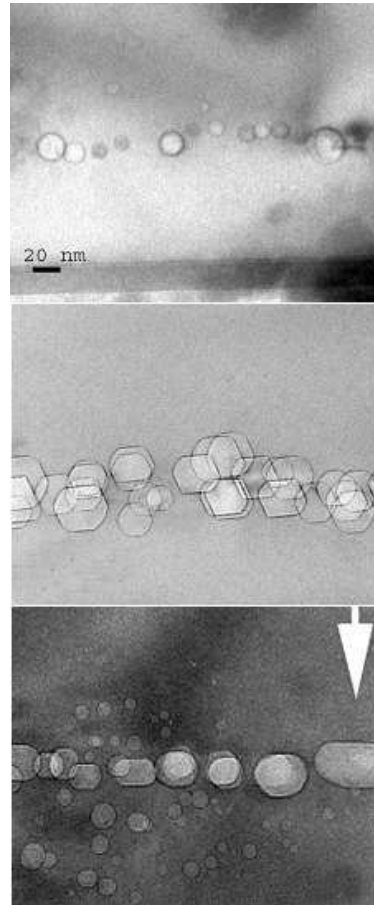


Fig. 2: He-induced cavities without (upper) and with (bottom) plasma treatment