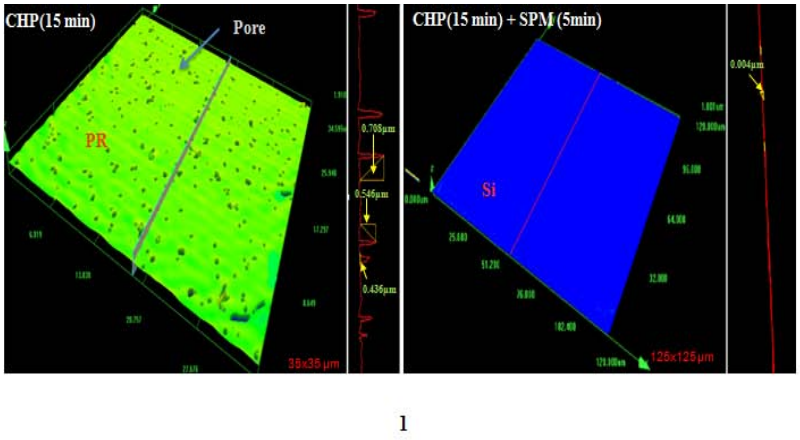
I. Deliverable:

Name: Optimize conditions to attack/disrupt/penetrate films; evaluation of two step (CHP followed by conventional SPM) process to strip films.
Task ID: 425.033
Task Title: Development of an All-Wet Benign Process Based on Catalyzed Hydrogen Peroxide (CHP) Chemical System for Stripping of Implanted State-of-the-Art Deep UV Resists
Task Leader: Srini Raghavan – The University of Arizona

II. Technical Results:

CHP solutions containing 5mM Fe^{2+} and 20% H_2O_2 (pH ~2.8) have been identified to be capable of disrupting crust layer on high dose (As 1E16/cm^2) implanted photoresist (PR) films. A two step process of CHP treatment followed by 2:1 sulfuric acid-peroxide mixture (SPM) solution treatment at 120^0C was developed to strip the resist films in a Laurel spinner. Morphological changes and extent of film removal after CHP/SPM treatment were characterized using a Leeds Confocal microscope equipped with LEXT OLS software.

Figure 1 presents confocal images of CHP treated and CHP followed by SPM treated PR films. The exposure time for CHP was 15 minutes whereas SPM was dispensed for 5 minutes. From the images, it is clear that CHP exposure created pores (depth <700 nm) on PR films. Access to SPM is provided by pores, aiding in the removal of crust as well as bulk resist. It may be noted from Figure 2 that while treatment with CHP or SPM alone is ineffective in complete removal of resist, the two step process removes the entire resist film.



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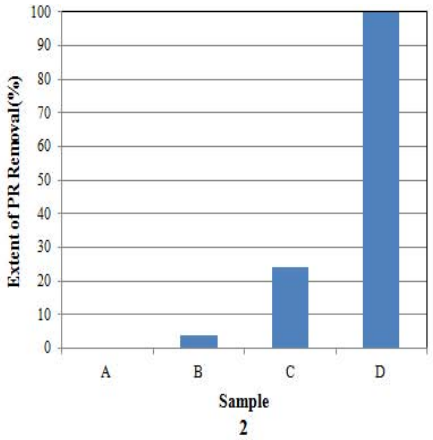

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Figure 1: Confocal microscopic images (magnification 14Kx) of implanted PR films after treatment with 20% H_2O_2- 5mM Fe^{2+} CHP solution for 15 minutes (left) and CHP followed by 2:1 SPM (5 minutes) treatment (right).

Figure ***2***: Extent of PR removal - Blanket PR (A), PR exposed to CHP for 15 minutes (B), 2:1 SPM for 5 minutes (C), CHP (15 minutes) followed by 2:1 SPM (5 minutes) (D)

Conclusion:

Excellent removal of implanted photoresist films is possible by first treating the films in CHP solution followed by exposure to conventional 2:1 SPM solution.