

REMOVAL OF COPPER FILMS IN HYDROXYLAMINE AND HYDROGEN PEROXIDE SOLUTIONS USING A FIXED ABRASIVE PAD

Wayne Huang, Subramanian Tamilmani,
Srini Raghavan, Morgan Hart,
and Creighton Anderson
*Dept. Materials Science and Engineering
University of Arizona, Tucson, AZ*

Robert Small
EKC Technology, Inc., Hayward, CA

The use of fixed abrasive pads (FAP) for copper CMP is beginning to receive considerable amount of attention. In the FAP based CMP process, only a chemical solution is required for the removal of films and consequently, the process waste is easier to treat than the conventional CMP waste. This paper presents results of a basic investigation undertaken to characterize the abrasion of copper films using a fixed abrasive pad in terms of removal rate as well as the particulate waste generated.

The abrasion of electrodeposited copper films using an alumina based fixed abrasive pad (FAP) was studied in hydrogen peroxide and hydroxylamine solutions in a laboratory scale tester. The removal rate of copper in hydroxylamine based solutions (0.5 M) was much higher than that in peroxide based solutions (1.2 M) in the pH range of 3 to 9 (Figure 1). Abrasion in peroxide chemistry resulted in the formation of copper and aluminum based particulates in to solution (Figure 2). The extent of copper based particulates was dependent on the pH of the peroxide solutions. In hydroxylamine based solutions, particulate generation was minimal. Low particulate generation at pH values less than 7 may be attributed to the formation and stability of copper-hydroxylamine complexes.

Using electrochemical techniques, galvanic corrosion between copper and Ta *during abrasion* was studied. Results of galvanic corrosion experiments conducted in hydrogen peroxide and hydroxylamine based systems will be presented and discussed.

Acknowledgements:

This work was supported by the NSF-SRC Center on Environmentally Benign Semiconductor Manufacturing at the University

of Arizona and EKC Technology, Inc., Hayward, California.

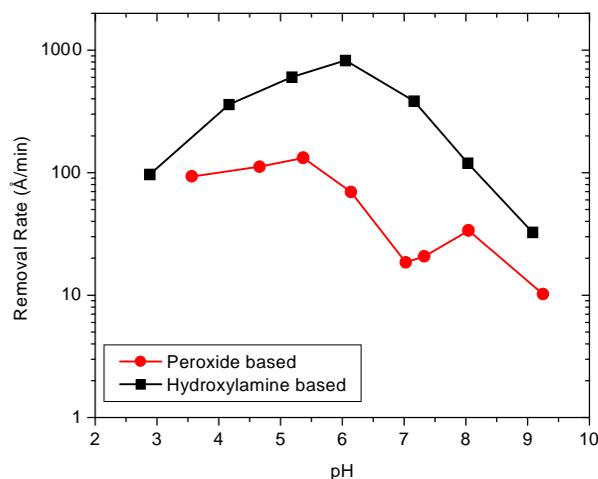


Figure 1. Removal rates of copper in 1.2M peroxide and 0.5M hydroxylamine based chemistry as a function of pH.

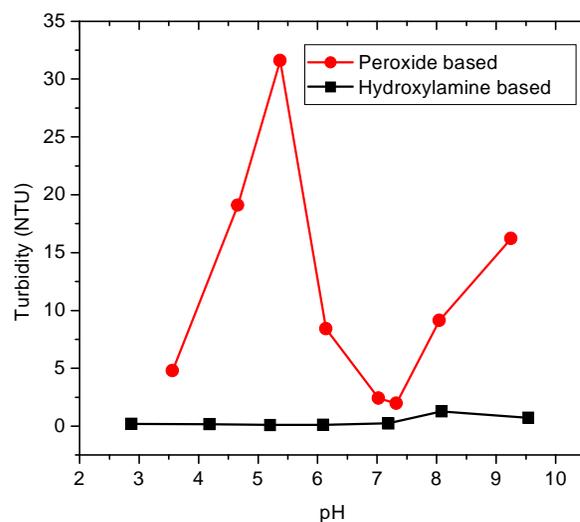


Figure 2. Turbidity of the solutions after abrasion as a function of pH. [In peroxide based chemistry, the abrasion time was 60 minutes. For hydroxylamine based chemistry, the abrasion time varied from 15 to 60 minutes depending on the pH.]