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Effects of atmospheric pressure plasma in aqueous solution on dissolution of copper residues

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Back End of Line (BEOL) cleaning of copper based structures requires chemical formulations that can remove copper oxide selectively without corroding copper and etching the dielectric. Many commercially available semi-aqueous and all aqueous formulations claim to meet these criteria. At the 32 nm node, many companies are likely to cap copper interconnects with self-aligned barriers of CoWP to improve reliability. However, these more complex structures make it difficult to use the conventional solution for post-etch cleaning, due to copper loss and the galvanic corrosion that occurs in the less-noble cobalt-based capping layer. Non-equilibrium plasma discharges allow to modify the surface chemistry of materials by generation of energetic and chemically active species in gas or liquid phase. Discharges in and in contact with liquids generate intense UV radiation, shock waves and reactive radicals (OH, atomic oxygen peroxide, etc.) which are believed to be effective agents to convert many forms of chemical matter. Therefore, the combination of plasma discharge and cleaning solution may be very desirable to enhance the cleaning effect in BEOL through the creation and activation of reactive ions in the solution. In this study, several aqeuous solutions with atmospheric plasma discharges have been evaluated for the application of post-plasma etch residue removal at various plasma configurations and process conditions, which is required after plasma etching and the subsequent ashing process. This presentation will report the results from a fundamental study undertaken to evaluate the performance of a liquid-atmospheric plasma discharges in removing copper oxide films grown on copper.

Keywords
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