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Abstract
In our study, the using of Co(II) as a reducing agent and the electroless copper plating electrolyte which pH is near 7.0, make it possible to improve the environments during and after the operation. On the other hand, we make the best use of the effects of jet flow, shock wave and water-hammer which is produced by cavitation phenomenon due to ultrasonic irradiation. We expected that the electroless copper films can be more fine, smooth and superfilling in the presence of ultrasonic irradiation. Further, the effects of ultrasonic irradiation would be improved the defects of the lower deposition rate and the poor superfilling. First, we carried out some experiments and found out the best parameters. Then, the best parameters had been applied to electroless plating process on the silicon wafer substrate. After electroless plating, the crystal microstructure, surface morphology and electric properties of electroless copper films were investigated by SEM, EDX, AFM, XRD and 4-Point Probe.

The temperature of the electrolyte affected remarkably the deposition rate and the quality of electroless copper films. After the several temperatures were compared, we could obtain the best electroless copper films when the temperature of electrolyte was 50 ℃. With and without ultrasonic irradiation conditions, it could be obtained the best electroless copper films when the electrolyte contains 2,2’-dipyridyl and ascorbic acid compared with the other electrolyte conditions. Ultrasonic irradiation affected remarkably the roughness, deposition rate and fine particles of electroless copper films. The electroless copper films had became more fine with increasing of intensity of ultrasonic irradiation. In our study, the range of intensity used due to ultrasonic irradiation almost didn’t affect the crystal microstructure of electroless copper films. Ultrasonic irradiation had been improve the superfilling effects for any electrolytes in our system, especially the intensities of ultrasonic irradiation were over 72 W. In the presence of ultrasonic irradiation(72 W), the resistivity of the electroless copper films was 1.91μΩ-cm remarkably lower than the 2.48μΩ-cm of resistivity in the absence of ultrasonic irradiation. Further, the resistivity decreased with increasing of intensity of ultrasonic irradiation. With and without ultrasonic irradiation conditions, the resistivity of electroless copper films after annealing (400 ℃) was lower than before annealing.
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