URN etd-0407109-183707-492
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Statistics This thesis had been viewed 46 times. Download 0 times.
Department
Year 2002
Semester 2
Degree Master
Type of Document Master's Thesis
Language zh-TW.Big5 Chinese
Title Influence of Ultrasonic Irradiation on Electroplating Copper Metallization of ULSI
Date of Defense 0000-00-00
Page Count 130
Keyword
Ultrasonic irradiation
Copper electroplating
Additive
Cavitation
Superfilling

Abstract
The electroplating is the major method for IC interconnection metallic process. The electroplating method has some advantages of low cost, low toxicant, high deposition rate, good quality of the copper film morphology and simple operation system, but the defect is the fair-poor filling. In this study, we focused the effects which the jet flow、shock wave and water-hammer effects due to cavitation phenomenon in the presence of ultrasonic irradiation and the addition of additives. We expected these effects could be achieved the leveling and the superfilling of deposited copper film.

The optimum conditions of copper electroplating had been decided with investigation of limiting current density and deposited copper film morphology with and without ultrasonic irradiation. Then, the optimum conditions had been applied to copper electroplating on silicon wafer substrate. After electroplating the surface morphology and the electric properties had been investigated by SEM、XRD、AFM and Four-Point Probe.

The limiting current density was increasing with increasing of the power density of ultrasonic irradiation, but the wasn’t affected as power density of ultrasonic irradiation low than 30 W/cm2. In the presence of ultrasonic irradiation could be obtained more fine and lower roughness of deposited copper morphology. Further, the effects on surface morphology was increasing with increasing of power density of ultrasonic irradiation. The surface roughness was decreasing with increasing of the Polyethylene Glycol (PEG) molecular weight, and was decreasing with increasing of the concentration of Janus Green B (JGB) as a constant amount PEG. On the other hand, the surface roughness with adding two additives condition was lower than only one additive condition. The resistivity was not affected in the presence of ultrasonic irradiation, but increasing with added additives. The trench filling was not affected remarkably as only one additive condition in the presence of ultrasonic irradiation. On other hand, it could be obtained the superfilling effect as added 300 mg/L PEG 6000 and 1 mg/L JGB with 180 W/cm2 ultrasonic irradiation condition.
Advisory Committee - advisor

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Date of Submission 2004-02-11