Study on the reative ion etching for via opening in multi-layer MCM-D substrate fabrication processes

다층 구조 MCM-D 기판 제조에서의 반응성 이온 식각을 이용한 비아 형성법에 관한 연구

Hyoung-Soo Ko and Kyung-Wook Paik
Dept. of Mat. Sci. & Eng, KAIST, Taejon 305-701, Korea
alpha@cais.kaist.ac.kr

I. Introduction

Dry etching of polyimides and other polymer films has become very important in the fabrication of microelectronic devices. The use of polyimide films as an interlayer dielectric material and the need to etch precise vias in these films require greater control of the polymer etching processes and better understanding of the etching mechanism. The main objectives of this work are to investigate the effects of RIE conditions on the etch rate and the sidewall angle of polyimide vias and to set up optimum process conditions for clean and adequately sloped vias.

II. Experimental

Experiments were performed in a parallel plate reactive ion etcher. And a plasma is excited by 13.56 MHz RF with maximum power of 600 watt generator. Etching was carried out in a pure oxygen plasma and Ar plasma was additionally employed to investigate the effect of that on the removal of oxygen RIE residue. RF power and plasma pressure were varied to investigate the effects of those on the etch rate and via shape.

III. Result and Discussion

At the constant RF power, the etch rate of polyimide increased as the plasma pressure but it was supposed to be decreased at the higher pressure, which can be explained on the base of the decreased average energy of plasma, especially oxygen radicals, acting as a major role in RIE. And Al pad damage was observed for the high RF power. The RIE residue significantly increased as plasma pressure increased

The sidewall angle increased with increaseing RF power because the influence of ion bombardment was dominant at high RF power, leading to the anisotropic etching of the film. On the contrary the isotropic etching by oxygen radicals was enhanced at the low RF power and high pressure. which resulted in the decreased and sloped sidewall angle.

CF4 addition to pure O2 plasma greatly reduced the amout of residue on the exposed metal pads.