有機添加劑和改變稀釋比例之化學機械研磨

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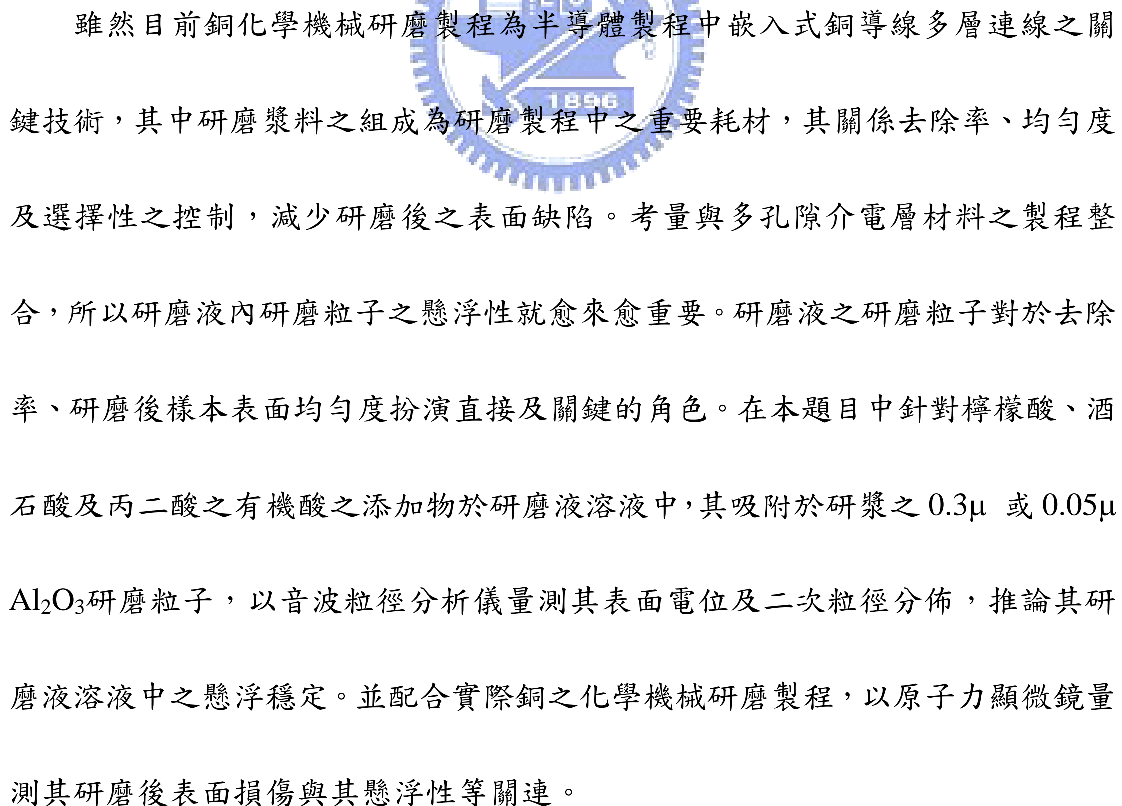
摘　要



雖然目前銅化學機械研磨製程為半導體製程中嵌入式銅導線多層連線之關鍵技術，其中研磨漿料之組成為研磨製程中之重要耗材，其關係去除率、均勻度及選擇性之控制，減少研磨後之表面缺陷。考量與多孔隙介電層材料之製程整合，所以研磨液內研磨粒子之懸浮性就愈來愈重要。研磨液之研磨粒子對於去除率、研磨後樣本表面均勻度扮演直接及關鍵的角色。在本題目中針對檸檬酸、酒石酸及丙二酸之有機酸之添加物於研磨液溶液中，其吸附於研漿之 0.3μ 或 0.05μ Al_2O_3研磨粒子，以音波粒徑分析儀量測其表面電位及二次粒徑分佈，推論其研磨液溶液中之懸浮穩定。並配合實際銅之化學機械研磨製程，以原子力顯微鏡量測其研磨後表面損傷與其懸浮性等關連。

目前在現今一般半導體廠內，化學機器研磨之研磨液是大量使用的耗材，本題目中我們希望藉著稀釋研磨液來降低生產成本，稀釋研磨液會使固含量下降和改變研磨液酸鹼度，進而影響去除率、表面均勻度、研磨粒子的懸浮性。若再添加不同的雙氧水濃度，會使鎢表面形成更複雜的化學反應。本研究調配研磨液W2000不同稀釋比例和不同濃度雙氧水等不同配方並輔以動態光粒徑分析儀、電化學儀器、電子能譜儀和測量鎢栓塞接觸電阻來做分析，尋找出最佳化的研磨液。

Cu-CMP with Organic Additive and W-CMP with Different Dilution Ratio

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Abstract

Although Cu-CMP is the key point in dual damascene structure in semiconductor manufacture, that the composition of slurry is the significant cost, it will affect the polishing rate, uniformity, selectivity and surface defeats…etc. In order to integrate with porous material, the abrasives in the slurry become more important. Abrasive plays a important role for the polishing rate and surface uniformity. In this thesis, we added the citric acid, tartaric acid and molonic acid in the slurry. It would be attracted on the 0.3μ or 0.05μ aluminum oxide abrasives, that the slurry would be measured by DT1200 to reason the stability of suspension of the slurry. Cu surface roughness after polishing with above slurry formulation was characterized by AFM. The relationship between surface damage after polishing and suspension stability was discussed.

For the moment, the slurry of CMP is the wasted source, so we want to dilute the slurry. The solid content in the diluted slurry would be decrease and the pH of slurry would be changed, so the diluted slurry would affect the polishing rate, surface uniformity, suspension of the abrasive. If there would be different concentration of hydrogen peroxide, it would form more complex chemical reaction on the tungsten surface. In this study, we would like to formula the optimize slurry, and we use the dynamic light analysis, electrochemical instrument, XPS and contact resistance of tungsten plug to find it out.