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Micro Porous Interlayer Formation by Sol-Gel Process

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1. INTRODUCTION

In general sol-gel process starts from formation of a homogeneous solution of raw materials, and subsequent gelatin of the solution for passing through a porous amorphous oxide to give a glass or a polycrystalline ceramic.[1-3] Most frequently, organometallic compounds such as alkoxides were dissolved in alcohol to give a homogeneous solution. Recently, ceramic substrate is selected for an alternative substrate board for high-speed circuits due to its low-thermal expansion. [4] Generally, metallization of ceramic substrate is fabricated by copper deposition. But it has been troubled for its weak adhesion between ceramic boards and copper layers. To enhance adhesion strength, anchoring effects of the coated layer on ceramic substrate were achieved by heat treatment of interlayer for • codierite formation. In this research, sol-gel process was prepared to keep sol solution as homogeneous and maintain solution as low temperature as possible.

2. EXPERIMENTAL PROCEDURES

Sol solution was mixed with metal salts and metal alkoxide as the starting materials. Composition of sol solution is indicated at Table1.TEOS-$Si(OC_2H_5)_4$ as a metal alkoxide and ANE-$Al(NO_3)_3 \cdot 9H_2O$, MAT-$(CH_3COO)_2Mg$ salts were used as raw materials. The mole ratio of TEOS: ANE: MAT: EtOH was 1:0.3~0.9:0.4:0.75. Fig.1 shows experimental procedure for sol-gel films fabrication. Alcoholic solution containing TEOS, ANE and MAT was stirred at room temperature for 24hr to obtain transparent solution. The synthesized sol-solution was coated by the dip coating method on ceramic substrate. After film coating process, coated layers were heat treated at 1100 ℃ to obtain gel films. Generally ceramic substrate is metallized by copper deposition, but it has been troubled by weak adhesion between the ceramic

substrate and copper layer. Therefore, in this research, in order to improve adhesion of electroless copper deposited layers to ceramic substrate, the synthesized sol solution were coated for giving anchoring effects to the interlayer films. Adhesion between ceramic substrate and copper layer was investigated by peeing test. To decide composition of sol solution, DTA and XRD patterns were investigated to identify the crystallization of heat-treated interlayer. SEM and ESCA were used for analyzing morphologies of coated interlayer.

3. RESULTS SUMMARY

Transition to cordierite crystalline phase of $SiO_2-Al_2O_3-MgO$ by heat treatment at 1010℃ could be confirmed by XRD. Adhesion strength by peeling test showed a maximum value of 1150gf/cn^2 at mole ratio of TEOS: ANE=1:0.7, which was about 10 times more than uncoated ceramic boards. Surface morphologies of the coated films were observed by SEM microscope. SEM micrograph showed many voids formed on interlayer films, which were increased according to adding Al_2O_3 amount in the range of experimental conditions.

REFERENCES

1.Yang,Y.,Zhu,Z., □Studies on sol-gel transition and reaction mechanisms□, J.of functional Materials, v.30,No.1,1999,pp78-81

2. B.N.Pub.Co.□Advances in sol-gel technology within the past several years□, ceramic industry,v.151,No.13,2001,pp17-20

3.Kureti,S.,□Development of the sol-gel transformation and characterization of the xerogel,□ J.of non-crystalline solids,v.303,No.2,2002,pp253-261

4.Sakka,Sumio,□Sol-gel technology as reflected in journal of sol-gel science and technology□, J.of sol-gel science and tech.,v26,No.1/3,2003,pp29-33