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Parameters determination for modelling of copper electrodeposition in through-silicon-via with additives

Yan Wang[1,2], Xin Deng[1,2], Xinyu Ren[1,2], Xiang Li[3,*], Fuliang Wang[1,2,*] , Wenhui Zhu[1,2,]

[1] State Key Laboratory of High Performance Complex Manufacturing, Central South University, Changsha 410083, China

[2] School of Mechanical and Electrical Engineering, Central South University, Changsha 410083, China

[3] School of Resources and Safety Engineering, Central South University, Changsha 410083, China

* Corresponding Author**:** E-mail: lixiang2006lixiang@hotmail.com;

wangfuliang@csu.edu.cn

ABSTRACT: Copper electrodeposition in through silicon via (TSV) with additives is a complicated process. Experimental methods are proposed to determine parameters (exchange current density on the cathode covered by additives, cathodic transfer coefficient and effective diffusion coefficient of additives) which are used in the mathematical model describing the copper electrodeposition process controlled by the additives. Linear scan voltammetry and Bulter-Volmer equation are used to determine the exchange current densities and cathodic transfer coefficients for different cathodic surfaces (free-occupied cathode, accelerator-covered cathode and suppressor-covered cathode). Effective diffusion coefficients of additives in plating bath used in TSV-filling model are calculated according to injection experiments and Wilke-Chang equation. The curvature effect, surface diffusion and surface convection are considered in the copper electrodeposition model. Both numerical simulation and experiment are performed on the copper electrodeposition of TSV with Ø20 um×65 um, and comparisons are made to validate the model. The dynamic profile of TSV and the

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