

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Taiwan Semiconductor Manufacturing Company Limited

Petitioner

v.

Godo Kaisha IP Bridge 1

Patent Owner

DECLARATION OF DR. SANJAY K. BANERJEE

**IN SUPPORT OF PETITIONER'S REPLY TO PATENT OWNER'S
RESPONSE AND OPPOSITION TO MOTION TO AMEND**

**FOR *INTER PARTES* REVIEW OF UNITED STATES
PATENT NO. 6,538,324**

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I, Sanjay Kumar Banerjee, declare as follows:

I. INTRODUCTION

1. My name is Dr. Sanjay Kumar Banerjee, and I submitted an expert declaration (Exhibit 1003) in this proceeding on June 24, 2016.

2. I have been asked to submit this declaration on behalf of Taiwan Semiconductor Manufacturing Company Limited (“TSMC” or “Petitioner”) in connection with its Reply to Patent Owner’s Response and Opposition to Patent Owner’s Motion to Amend Claims in the current proceeding.

3. I have been asked to provide opinions in response to certain positions taken by IP Bridge (“Patent Owner”) in its Patent Owner’s Response and Motion to Amend Claims. My opinions in this declaration are presented in addition to my opinions in my previous declaration. This declaration does not replace, modify, or withdraw any of my earlier opinions and analyses offered in this proceeding.

II. MATERIALS REVIEWED

4. In forming my opinions, I have reviewed the materials listed in my previous declaration (Exhibit 1003) and the following materials and any other materials I identify in this declaration or in my previous declaration:

- Exhibit 1001: U.S. Patent No. 6,538,324 to Tagami et al.
- Exhibit 1002: File History of U.S. Patent No. 6,538,324 to Tagami et al.
- Exhibit 1004: U.S. Patent No. 5,893,752 to Zhang et al.

- Exhibit 1005: U.S. Patent No. 6,887,353 to Ding et al.
- Exhibit 1006: Holloway et al., “Tantalum as a diffusion barrier between copper and silicon: Failure mechanism and effect of nitrogen additions,” *Journal of Applied Physics*, 71(11), 5433-5444 (1992).
- Exhibit 1007: Sun et al., “Properties of reactively sputter-deposited Ta-N thin films,” *Thin Solid Films*, 236 (1993) 347-351.
- Exhibit 1008: U.S. Patent No. 5,858,873 to Vitkavage et al.
- Exhibit 1009: U.S. Patent No. 5,668,411 to Hong et al.
- Exhibit 1010: Excerpt of El-Kareh, “Fundamentals of Semiconductor Processing Technologies,” Kluwer Academic Publishers (1995).
- Exhibit 1015: Stavrev et al., “Crystallographic and morphological characterization of reactively sputtered Ta, Ta-N and Ta-N-O thin films,” *Thin Solid Films*, 307 (1997) 79-88.
- Exhibit 1017: Duan et al., “Magnetic Property and Microstructure Dependence of CoCrTa/Cr Media on Substrate Temperature and Bias,” *IEEE Transactions on Magnetics*, Vol. 28, No. 5, September 1992.
- Exhibit 1019: Moussavi et al., “Comparison of Barrier Materials and Deposition Processes for Copper Integration,” *Proceedings of the IEEE 1998 International Interconnect Technology Conference*, pp. 295-97 (1998).
- Exhibit 1021: Wijekoon et al., “Development of a Production Worthy Copper CMP Process,” *1998 IEEE/SEMI Advanced Semiconductor Manufacturing Conference*, pp. 354-63 (1998).
- Exhibit 1023: Wang et al., “Barrier Properties of Very Thin Ta and TaN layers Against Copper Diffusion,” *J. Electrochem. Soc.*, Vol. 145, No. 7, pp. 2538-45.
- Exhibit 1025: U.K. Patent No. GB 2,298,657 to Cho.
- Exhibit 1026: U.S. Patent No. 5,780,908 to Sekiguchi et al.

- Exhibit 1027: U.S. Patent No. 5,869,902 to Lee et al.
- Exhibit 1028: U.S. Patent No. 5,882,399 to Ngan et al.
- Exhibit 1029: U.S. Patent No. 6,057,237 to Ding et al.
- Exhibit 1030: U.S. Patent No. 6,136,682 to Hegde et al.
- Exhibit 1031: U.S. Patent No. 6,242,804 to Inoue et al.
- Exhibit 1032: Annotated FIG. 4 of *Zhang* (Ex. 1004).
- Exhibit 1033: U.S. Patent No. 6,458,255 to Chiang et al.
- Exhibit 1034: Excerpt of “The American Heritage College Dictionary,” 3rd Ed., Houghton Mifflin Company (1993).
- Exhibit 1035: U.S. Patent No. 5,281,485 to Colgan et al.
- Exhibit 1036: May 5, 2017, Deposition Transcript of Harlan (Rusty) Harris, Ph.D., and all exhibits thereto
- Institution Decision in IPR2016-01249
- Institution Decision in IPR2016-01264
- Patent Owner Response in IPR2016-01249
- Patent Owner Response in IPR2016-01264
- Patent Owner’s Contingent Motion to Amend Claims
- Exhibit 2001: Chang, C.C., Chen, J.S. and Hsu, W.S., “Failure Mechanism of Amorphous and Crystalline Ta-N Films in the Cu/Ta N/Ta/SiO₂ Structure.” *Journal of The Electrochemical Society*, 151(11), pp.G746-G750 (2004).
- Exhibit 2002: U.S. Patent Application No. 08/995,108, Amendment “A” Under 37 C.F.R. §1.111, dated February 1, 2000.

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