

## Dr. TAMAL GHOSH

**Research Area** 3 Dimensional Integration, Micro and Nano-electronics

**Ph.D thesis title** “Low temperature & low pressure Cu-Cu thermo-compression bonding for 3D IC application”

**Abstract:** As the demand for more functionality and more features in a single chip is mounting, conventional planar integration is facing varieties of challenges to keep pace with Moore’s law. 3D IC is a new and emerging technology which can successfully overcome the challenges faced by 2D Integration. Wafer-Wafer thermocompression bonding is the basic building block for 3D Integration. This thesis discusses the thermocompression bonding at a reasonably low temperature and pressure which can open a new platform in 3D IC industry

**Ph.D:** IIT Hyderabad

**M-Tech:** RadioPhysics & Electronics, University of Calcutta

**Teaching experience:** Assistant Professor in University of Calcutta from Feb-2016 to Aug-2017  
**Patent for “Sub 100°C Cu-Cu thermocompression bonding”.**

### Journal Publications

1. Ghosh, Tamal, K. Krushnamurthy, Asisa Kumar Panigrahi, Asudeb Dutta, Ch Subrahmanyam, Siva Rama Krishna Vanjari, and Shiv Govind Singh. "Facile non thermal plasma based desorption of self assembled monolayers for achieving low temperature and low pressure Cu–Cu thermo-compression bonding." *RSC Advances* 5, no. 125 (2015): 103643-103648.
2. Ghosh, Tamal, Ashudeb Dutta, and Shivgovind Singh. "Copper Protection by SAM and Low Temperature Bonding for 3Dimentional Integration." In *Advanced Materials Research*, vol. 716, pp. 223-227. 2013.
3. Panigrahi, Asisa Kumar, Satish Bonam, Tamal Ghosh, Shiv Govind Singh, and Siva Rama Krishna Vanjari. "Ultra-thin Ti passivation mediated breakthrough in high quality Cu-Cu bonding at low temperature and pressure." *Materials Letters* 169 (2016): 269-272.
4. U. Chatterjee<sup>a, \*</sup>, A. Das<sup>a</sup>, T. Ghosh<sup>c</sup>, S.P. Duttagupta<sup>a</sup>, M.N. Gandhi<sup>b</sup>, S.G. Singh<sup>c</sup>, *Effect of post deposition annealing on thermal evaporated ZnSe:Te towards a scintillator application, Microelectronic Engineering, Volume 126, 25 August 2014, Pages 84–87*
5. Panigrahi, A. K., Ghosh, T., Vanjari, S. R. K., & Singh, S. G. (2017). Demonstration of Sub 150° C Cu-Cu thermocompression bonding for 3D IC applications, utilizing an ultra-thin layer of Manganin alloy as an effective surface passivation layer. *Materials Letters*. Volume 194, 1 May 2017, Pages 86-89, ISSN 0167-577X

## Conference Publications/Posters/Talks:

1. Ghosh, T.; Dutta, A.; Lingareddy, E.; Subrahmanyam, C.; Singh, S.G., *"Room temperature desorption of Self Assembly Monolayer (SAM) passivated Cu for lowering the process temperature Cu-Cu bonding of 3-D ICs," Emerging Electronics (ICEE), 2012 International Conference on , vol., no., pp.1,4, 15-17 Dec. 2012*  
doi: 10.1109/ICEmElec.2012.6636262
2. Patel, S.B.; Ghosh, T.; Dutta, A.; Singh, S., *"Stress analysis in 3D IC having Thermal Throug Silicon Vias (TTSV)," Electronic Components and Technology Conference (ECTC), 2013 IEEE 63rd , vol., no., pp.2337,2341, 28-31 May 2013*  
doi: 10.1109/ECTC.2013.65759104.
3. Ghosh, T.; Krishna, V.S.R.; Singh, S.G., *"Low temperature Cu-Cu thermocompression bonding assisted by electrochemical desorption of a self-assembled monolayer," Emerging Electronics (ICEE), 2014 IEEE 2nd International Conference on, vol., no., pp.1,4, 3-6 Dec. 2014,* doi: 10.1109/ICEmElec.2014.7151165
4. Ghosh, Tamal; Krushnamurthy, E.; Subrahmanyam, Ch.; SivaRamaKrishna, V.; Dutta, A.; Singh, S G, *"Room temperature desorption of Self Assembled Monolayer from Copper surface for low temperature & low pressure thermocompression bonding," Electronic Components and Technology Conference (ECTC) , 2015 IEEE 65th , vol., no., pp.2200,2204, 26-29 May 2015,* doi: 10.1109/ECTC.2015.7159908
5. Ghosh, Tamal; Gagan, G C; Dutta, Ashudeb; SivaRamaKrishna, Vanjari; Singh, Shiv Govind, *"Hybrid TTSV structure for heat mitigation and energy harvesting in 3D IC," Electronic Components and Technology Conference (ECTC) , 2015 IEEE 65th , vol., no., pp.1160,1162, 26-29 May 2015*  
doi: 10.1109/ECTC.2015.7159741
6. Panigrahi, Asisa Kumar; Bonam, Satish; Ghosh, Tamal; Vanjari, Siva Rama Krishna; Singh, Shiv Govind, *"Low temperature, low pressure CMOS compatible Cu -Cu thermo-compression bonding with Ti passivation for 3D IC integration," Electronic Components and Technology Conference (ECTC) , 2015 IEEE 65th , vol., no., pp.2205,2210, 26-29 May 2015*  
doi: 10.1109/ECTC.2015.7159909
7. Panigrahi, Asisa Kumar, Satish Bonam, Tamal Ghosh, Siva Rama Krishna Vanjari, and Shiv Govind Singh. "Long term efficacy of ultra-thin Ti passivation layer for achieving low temperature, low pressure Cu-Cu Wafer-on-Wafer bonding." In *3D Systems Integration Conference (3DIC), 2015 International*, pp. TS8-13. IEEE, 2015.
8. A. K. Panigrahi, S. Bonam, T. Ghosh, S. R. K. Vanjari and S. G. Singh, "High Quality Fine-Pitch Cu-Cu Wafer-on-Wafer Bonding with Optimized Ti Passivation at 160<sup>0</sup>C," *2016 IEEE 66th Electronic Components and Technology Conference (ECTC)*, Las Vegas, NV, USA, 2016, pp. 1791-1796., doi: 10.1109/ECTC.2016.369

## **Relevant Course Work**

Solid State Devices Modelling  
VLSI Technology  
Analog IC Design  
Digital IC Design