Influence of chemical composition of side inlet jet on deposition rate near wafer edge in APCVD process

Ba-Phuoc Le[1*], Wei-Jie Lin[1], Jyh-Chen Chen[1], Chieh Hu[2], Chun-Chin Tu[2], Liang-Chin Chen[2]

*E-mail address of lead presenter: lebaphuockor@gmail.com
[1]Department of Mechanical Engineering, National Central University, Taoyuan City, Taiwan
[2]Research and Development Division, Global Wafer Co., Ltd, Hsinchu City, Taiwan

As the size of semiconductor devices continues to shrink, the thickness uniformity of 12-inch silicon wafers plays an increasingly important role [1]. It is well known that APCVD is a common method for depositing high-quality silicon epitaxy on wafers [2]. A common way to achieve better thickness uniformity on silicon wafers is to adjust the mainstream flow velocity profile [2,3]. However, this adjustment results in poor thickness uniformity near the edge of the wafer. In this study, to overcome this problem, a side inlet is installed to introduce a side jet to change the deposition rate near the edge of the wafer without changing the deposition rate in most regions. A set of numerical simulations is carried out to study the mass, heat, reaction, and flow motion inside the APCVD reactor chamber. The results show that when the side jet touches the wafer edge, the deposition rate changes significantly near the wafer edge. In particular, the deposition rate increases near the edge when the side jet is pure TCS gas, whereas it decreases near the edge when the side jet is pure H_2 or HCl gas. The effects of the TCS mass fraction in the side jet of TCS-H_2 gas mixture and the HCl mass fraction in the side jet of HCl-H_2 gas mixture are also considered. Thus, the deposition rate profile near the wafer edge can be tuned by the chemical composition of the side jet.

References

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