

## Reaction Modeling on Titanium Nitride Byproducts in CVD Trap System

Seongho Choi<sup>1</sup>, Changhyun Pang<sup>1</sup>, Chehoo Cho<sup>2</sup>, Heeyeop Chae<sup>1\*</sup>

<sup>1</sup>Department of Chemical Engineering, Sungkyunkwan University

<sup>2</sup>Milaebo Tech. co. Hwasung

Chemical vapor deposition (CVD) of Titanium Nitride (TiN) is known as effective method to make barrier of diffusion on contact site between aluminum and silicon because of its properties in semiconductor industry. In chemical vapor deposition reactor for producing TiN, byproducts ( $\text{TiCl}_4 \cdot 4\text{NH}_3(\text{s})$ ) of the residual TiN deposition processes seriously damage the exhaust line and pumping system. The system of trapping TiN byproducts ( $\text{TiCl}_4 \cdot 4\text{NH}_3(\text{s})$ ) formed below  $200^\circ\text{C}$  should be located in just behind CVD chamber (Trap system). This study focuses on modeling the chemical formation of  $\text{TiCl}_4 \cdot 4\text{NH}_3(\text{s})$  by CFD to understand the character of the reaction products below  $200^\circ\text{C}$  we can control and reduce the unwanted TiN particle formed in the exhaust line and pumping system.

A three-dimensional model is developed and described for a Trap system in which the reaction product of gaseous  $\text{TiCl}_4$  with ammonia at low temperature is used. Our model simulation has a satisfactory agreement with experimental data of Trap system. The deposition rate of  $\text{TiCl}_4 \cdot 4\text{NH}_3(\text{s})$  is found to increase dominantly along with increasing temperature of trap body as suggesting that chemical vapor deposition of  $\text{TiCl}_4 \cdot 4\text{NH}_3(\text{s})$  is surface-reaction-controlled.

**Keywords:** : Titanium Nitride,  $\text{TiCl}_4 \cdot 4\text{NH}_3(\text{s})$ , Chemical Vapor Deposition, Trap system