mole fraction of DCS

$$y_{DCS} = \frac{Q_{DHS}}{Q_{NH3} + Q_{DCS}} = \frac{70\ sccm}{100\ sccm + 70\ sccm}$$

$$y_{DCS} = 0.4118$$

	n (mol)
Si_3N_4	0.0813
$SiCl_2H_2$	0.2439
NH_3	0.813

concentration of DCS

$$750 \times 10^{-3}\ Torr \times \frac{133.322\ Pa}{1\ Torr} = 33.33\ Pa$$

$$\frac{n}{V} = \frac{P_q}{RT} = \frac{(0.4118)(33.33\ Pa)}{(8.314\ J/(K \cdot mol))(770+273)\ K}$$

$$C_{DCS} = 9.97 \times 10^{-4}\ mol/m^3$$

kinetic Eq'n

$$J = k_0 \exp\left[\frac{-E_a}{RT}\right] C_{DCS}^{0.49}$$

$$= 82300\ s^{-1} \exp\left[\frac{-(169.4 \times 10^3\ J/mol)}{(8.314\ J/(K \cdot mol))(770+273)\ K}\right] (9.97 \times 10^{-4}\ mol/m^3)^{0.49}$$

$$= 9.14 \times 10^{-6}\ mol/(cm^3 \cdot s)$$ rate of change of C_{DCS}

deposition rate

Stoichiometric coefficient $SiCl_2H_2 : Si_3N_4 = 3 : 1$

approximate deposition rate $\approx \frac{1}{3}(9.44 \times 10^{-6}\ mol/(cm^2 \cdot s)) \simeq 3.05 \times 10^{-6}\ mol/(cm^2 \cdot s)$ by neglecting surface kinetics.

$$MW_{Si_3N_4} = 140.28\ g/mol$$

$$\rho_{Si_3N_4} = 3000\ kg/m^3$$

$$\frac{3.05 \times 10^{-6}\ mol}{m^2 \cdot s} \times \frac{140.28\ g}{mol} \times \frac{m^3}{3000 \times 10^3\ g} = 1.43 \times 10^{-10}\ m/s$$

Deposition rate = 1.43 Å/s = 85.8 Å/min