

Solution 400-8 fys4310 (maple work sheet)

Recapitulating problem

Wet thermal oxidation at 1000 °C, p= 640 Torr

Oxidation time 2 min.

a) assume tau=0, use deal grove , predict thickness

b)oxide is 60nm =6e-6 cm=0.06 μm, find suitable tau to use

[> **restart;**

We use equation 4.11 , we use x for oxide thickness (t_{ox} in book) ; We assume we have zero oxide thickness to start then tau=0.

and equation 4.11 becomes

$$\begin{aligned} > \text{eq1} := x^2 + A x = B (t + \tau); \\ & \text{eq1} := x^2 + A x = B (t + \tau) \end{aligned} \quad (1)$$

$$\begin{aligned} > \text{sol_eq1} := \text{solve}(\text{eq1}, x); \\ & \text{sol_eq1} := -\frac{1}{2} A + \frac{1}{2} \sqrt{A^2 + 4 B t + 4 B \tau}, -\frac{1}{2} A - \frac{1}{2} \sqrt{A^2 + 4 B t + 4 B \tau} \end{aligned} \quad (2)$$

$$\begin{aligned} > \text{eq2} := x = \text{sol_eq1}[1]; \\ & \text{eq2} := x = -\frac{1}{2} A + \frac{1}{2} \sqrt{A^2 + 4 B t + 4 B \tau} \end{aligned} \quad (3)$$

We have values for these parameters from table 4.1, unit μm and hours

$$\begin{aligned} > \text{pars} := \{A=0.226, B=0.287, \tau=0, t=2/60.0\}; \\ & \text{pars} := \{A = 0.226, B = 0.287, t = 0.03333333333, \tau = 0\} \end{aligned} \quad (4)$$

$$\begin{aligned} > \text{eq3} := \text{subs}(\text{pars}, \text{eq2}); \\ & \text{eq3} := x = 0.0364512184 \end{aligned} \quad (5)$$

The thickness is calculated to be 0.036 μm, it is actually 0.06

$$\begin{aligned} > \text{eq4} := 0.06 = \text{rhs}(\text{eq2}); \\ & \text{eq4} := 0.06 = -\frac{1}{2} A + \frac{1}{2} \sqrt{A^2 + 4 B t + 4 B \tau} \end{aligned} \quad (6)$$

$$\begin{aligned} > \text{parsb} := \{A=0.226, B=0.287, t=2/60.0, x=0.06\}; \\ & \text{parsb} := \{A = 0.226, B = 0.287, t = 0.03333333333, x = 0.06\} \end{aligned} \quad (7)$$

$$\begin{aligned} > \text{eq4} := \tau = \text{solve}(\text{subs}(\text{parsb}, \text{eq2}), \tau); \\ & \text{eq4} := \tau = 0.02645760744 \end{aligned} \quad (8)$$

The appropriate value for the constant tau would be 0.02646 hr