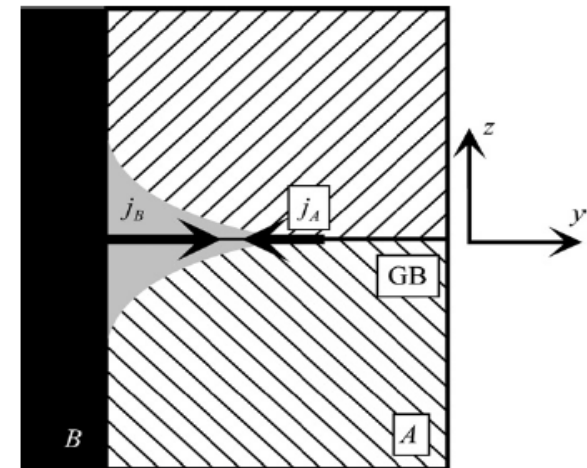
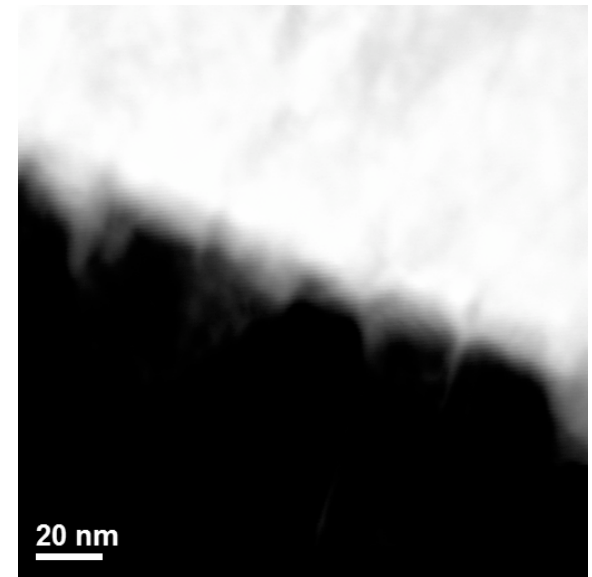
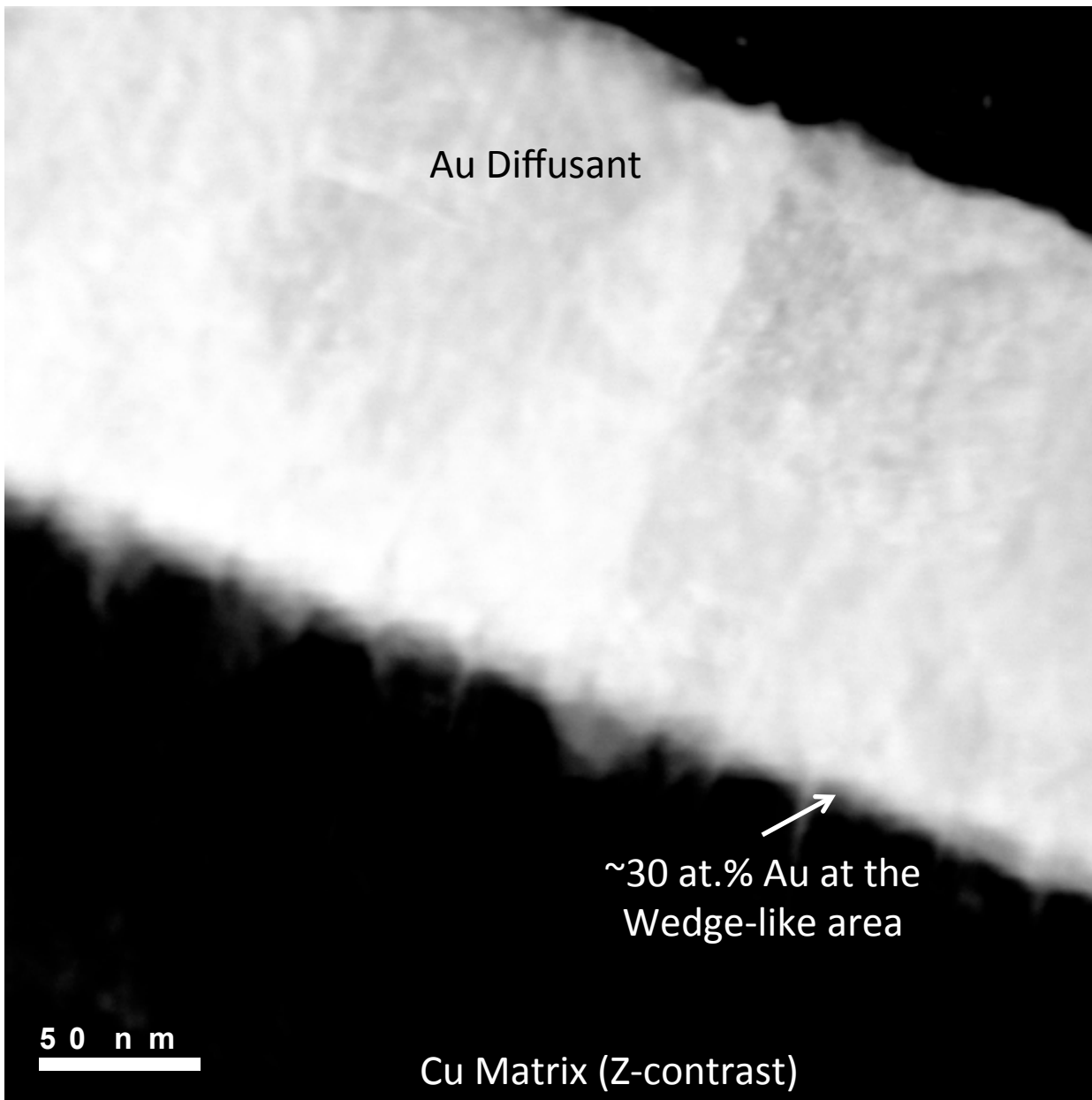
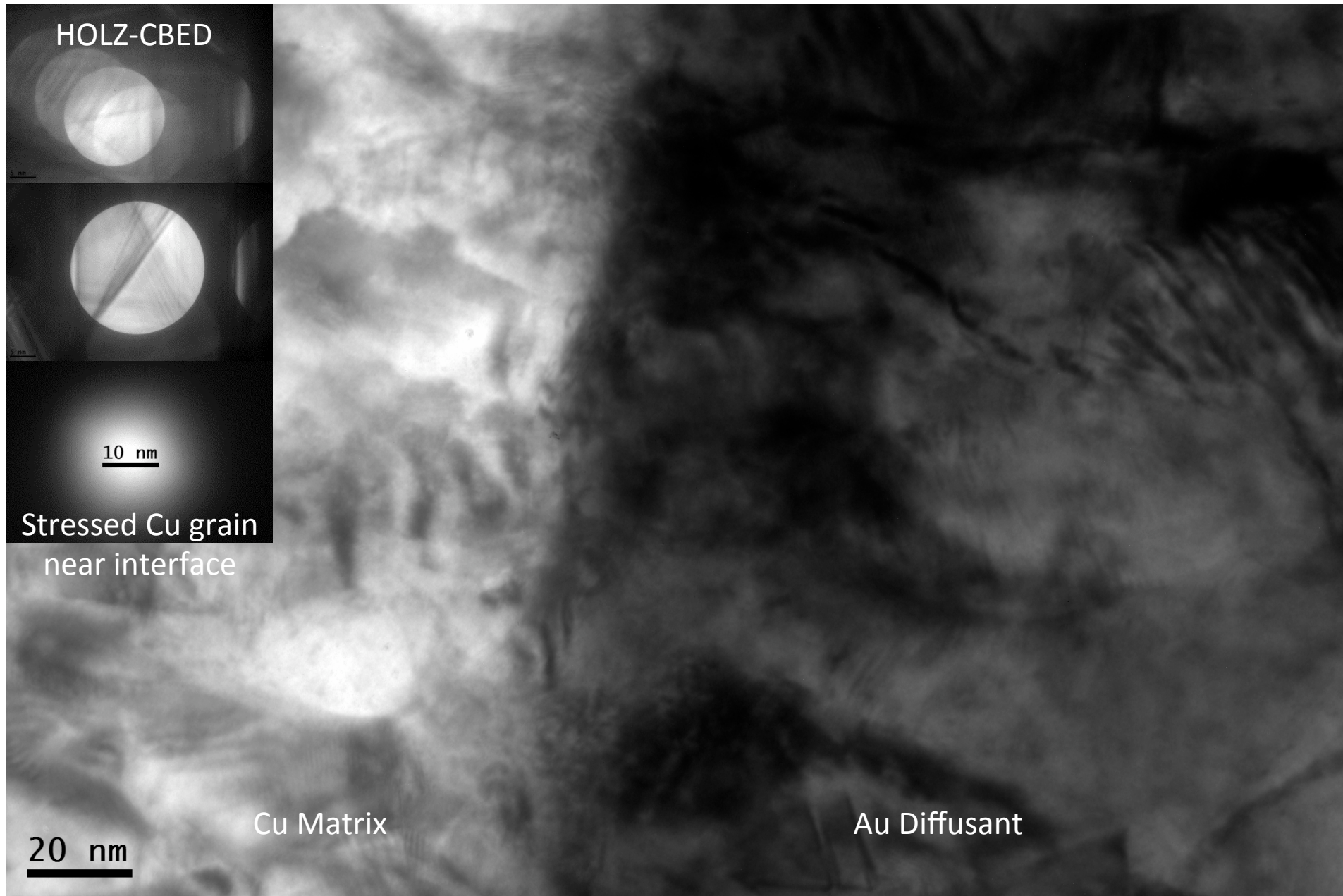


STEM of Au diffusion in Cu-W as-deposited sample (473K)



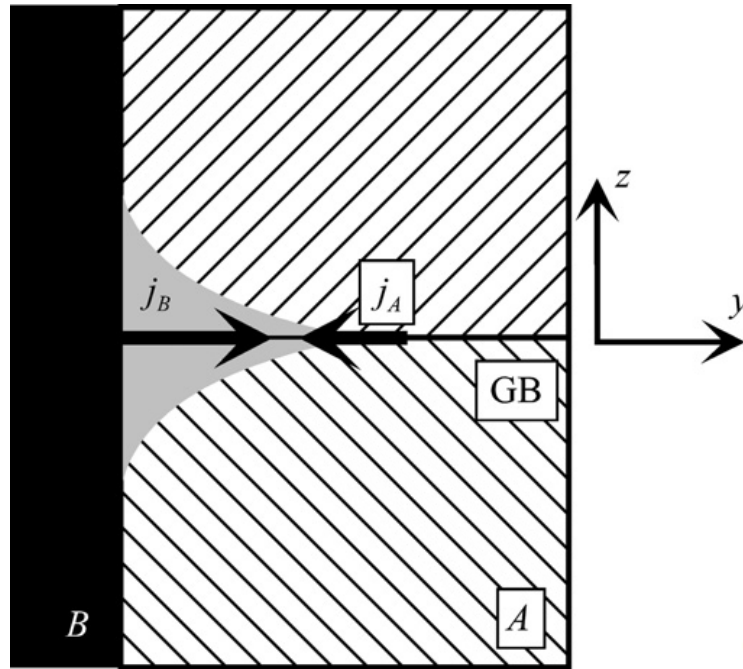
A-B
Inequality Diffusion

TEM of Au diffusion in Cu-W as-deposited sample (473K)



Coupled Stress/Diffusion Model

Kirkendall Effect induced
G.B. migration/lattice drift



A bicrystal of *A* with the layer of *B* deposited on the surface. The imbalance of diffusion fluxes of the two components, j_A and j_B , is caused by the difference in intrinsic diffusivities of *A*- and *B*-atoms along the GB. This imbalance leads to the formation of a wedge of extra material at the GB.

$$\mu_A = \mu_A^0 + kT \ln C_A + \Omega\sigma; \quad \mu_B = \mu_B^0 + kT \ln C_B + \Omega\sigma,$$

$$j_A = -\frac{D_A n_A}{kT} \frac{\partial \mu_A}{\partial y}; \quad j_B = -\frac{D_B n_B}{kT} \frac{\partial \mu_B}{\partial y},$$

$$\frac{\partial C_B}{\partial t} = D_B \frac{\partial^2 C_B}{\partial y^2} + \frac{D_B C_B \Omega}{kT} \frac{\partial^2 \sigma}{\partial y^2} + \frac{\Omega D_B}{kT} \frac{\partial C_B}{\partial y} \frac{\partial \sigma}{\partial y}$$

$$D_A < D_B$$

compressive stresses is located close to the bicrystal surface

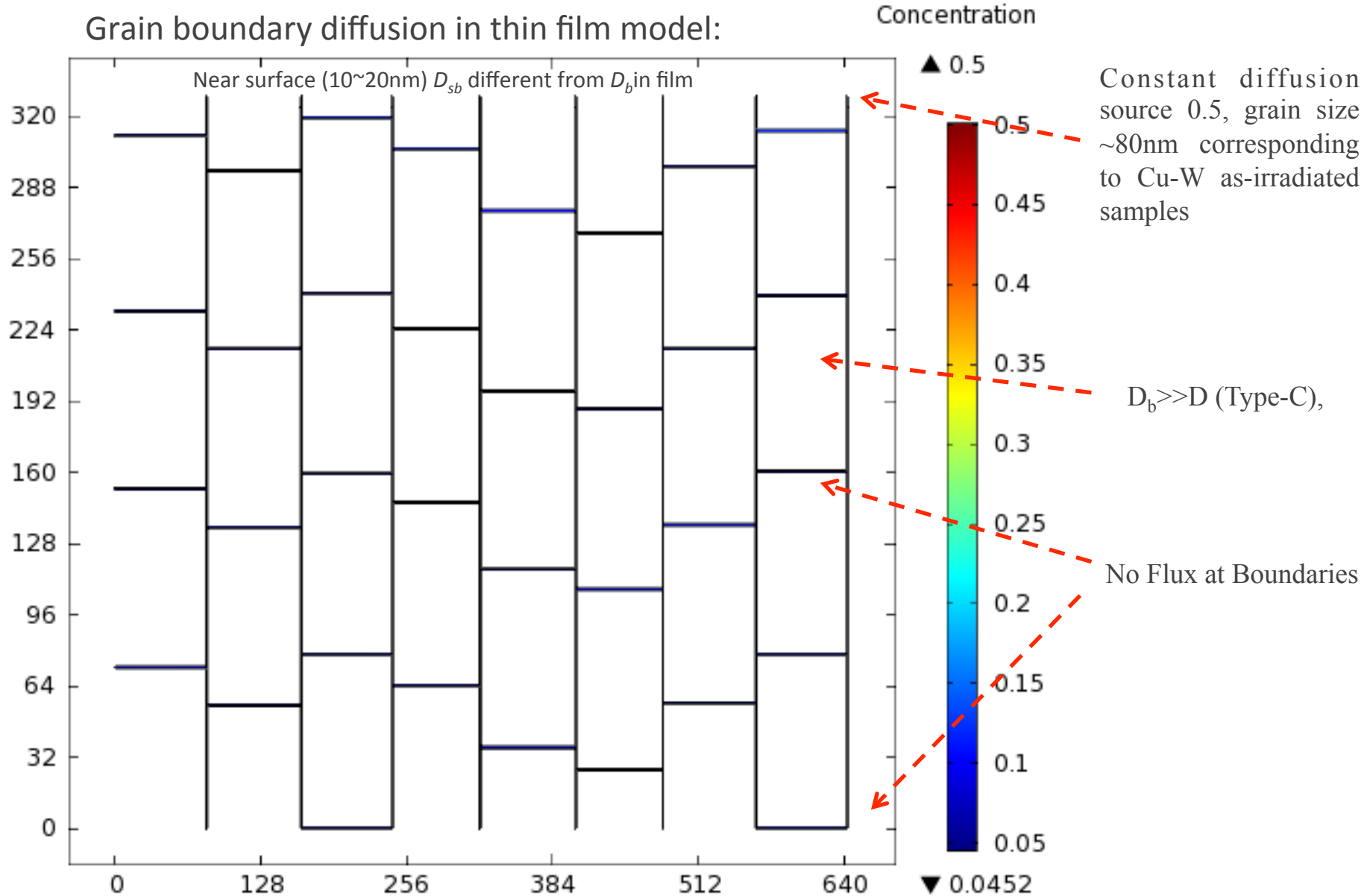
$$D_A > D_B$$

tensile stresses develops

close to the bicrystal surface.

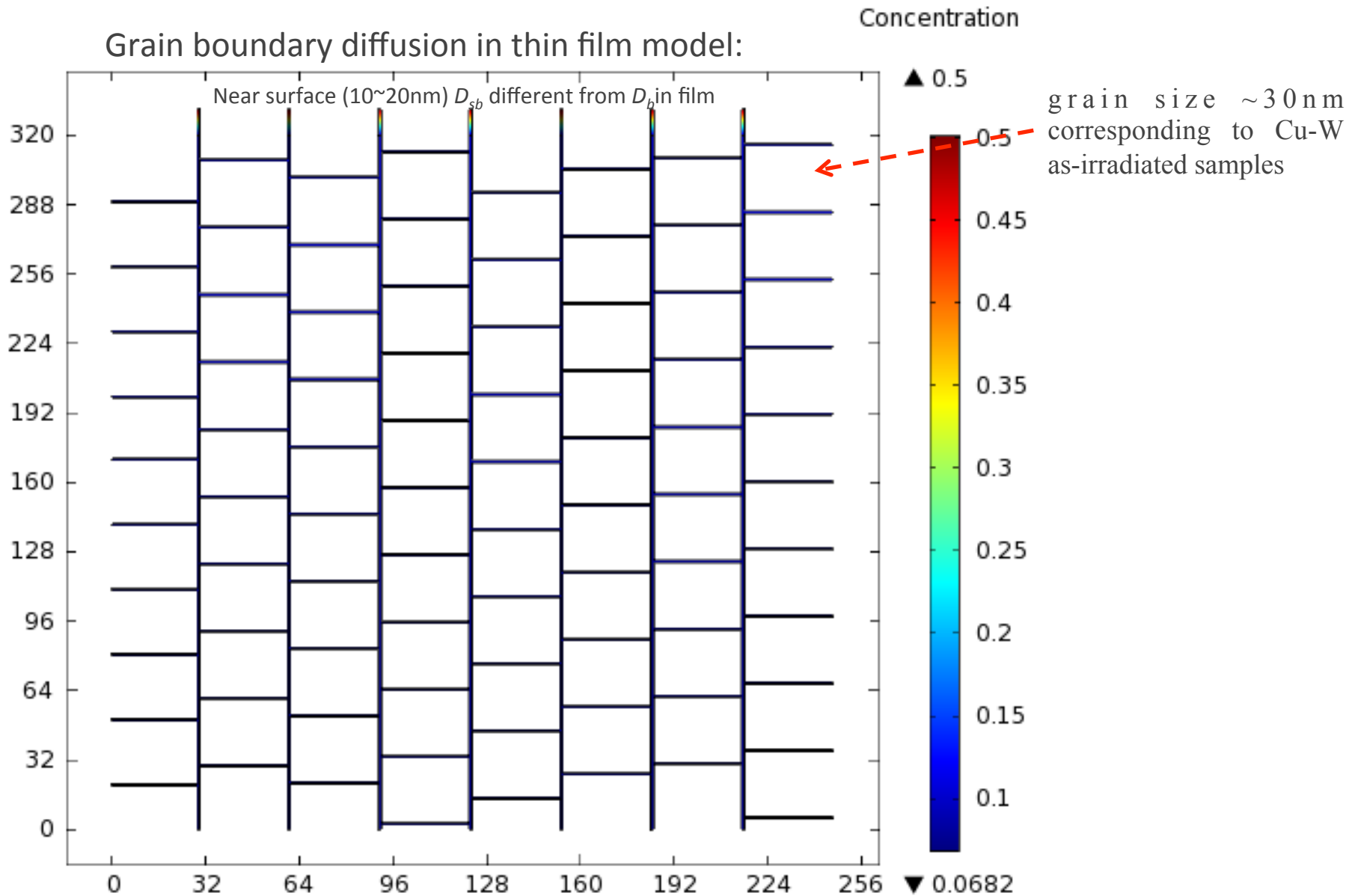
Finite Element Simulation

Grain boundary diffusion in thin film model:

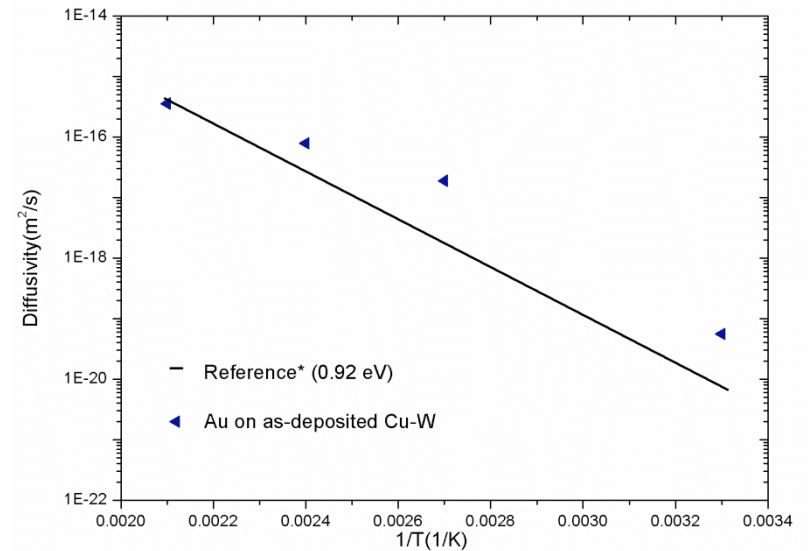
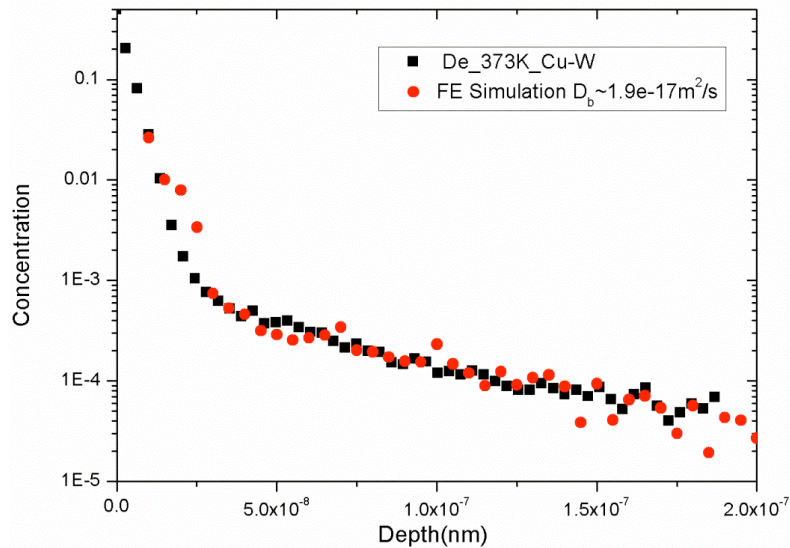
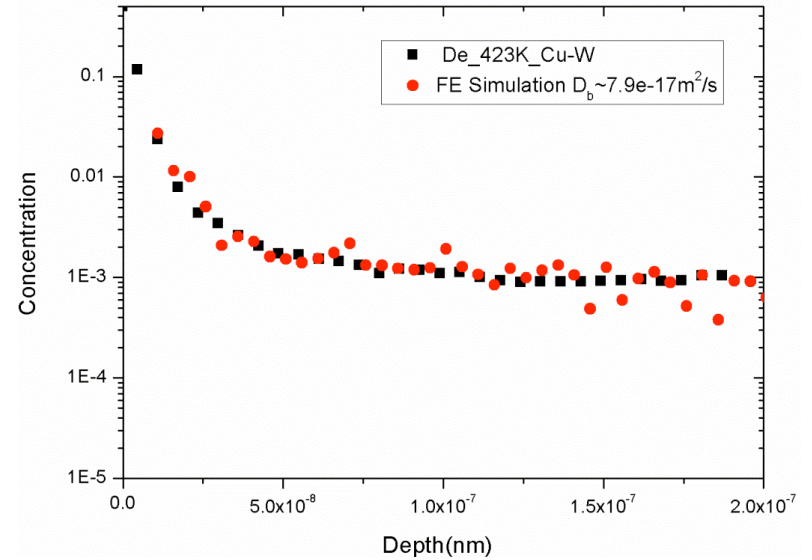
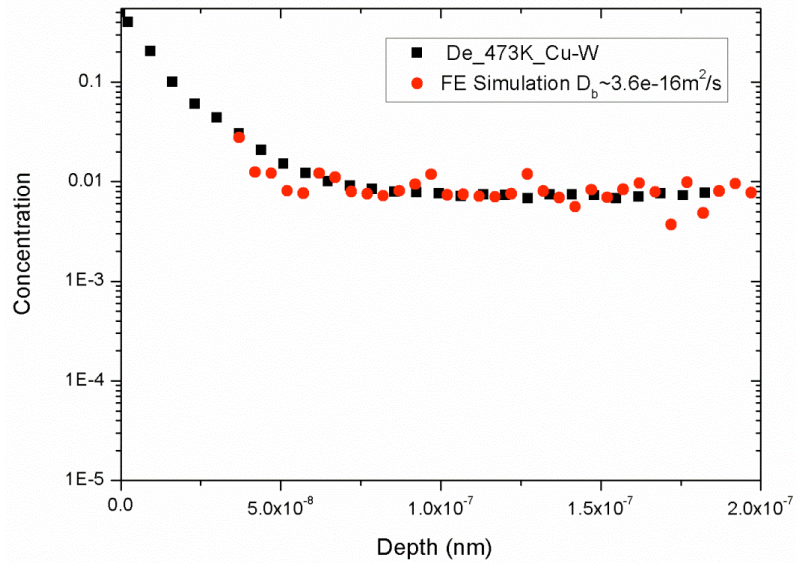


Finite Element Simulation

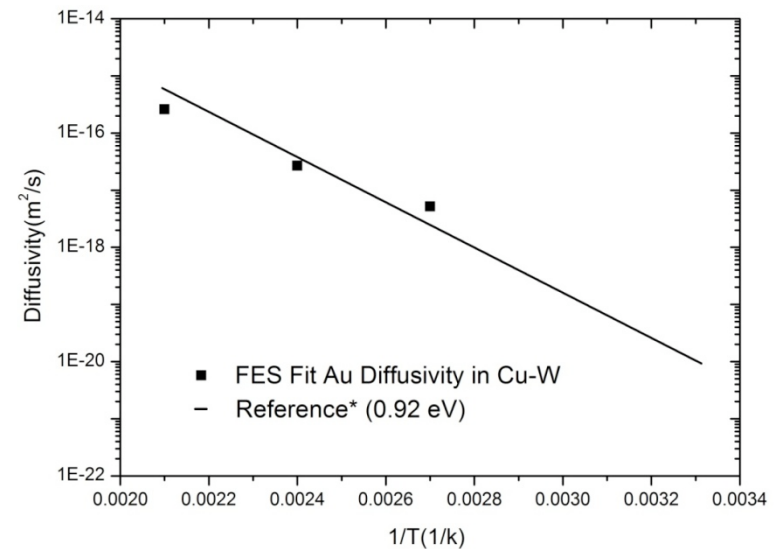
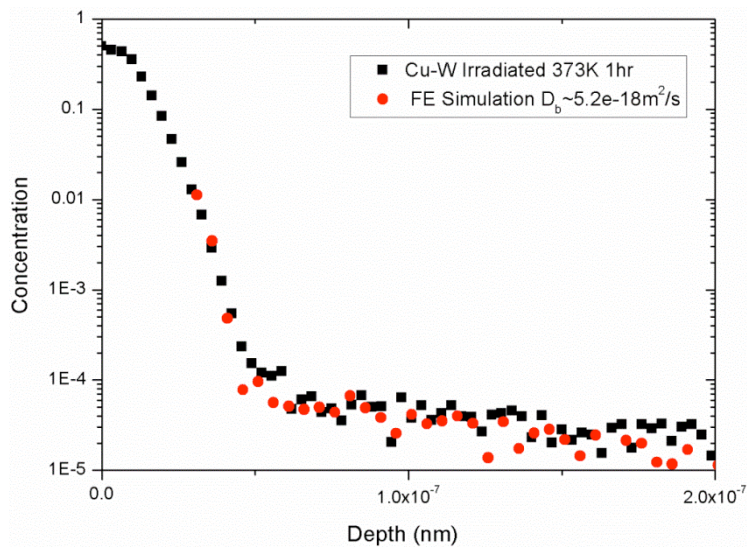
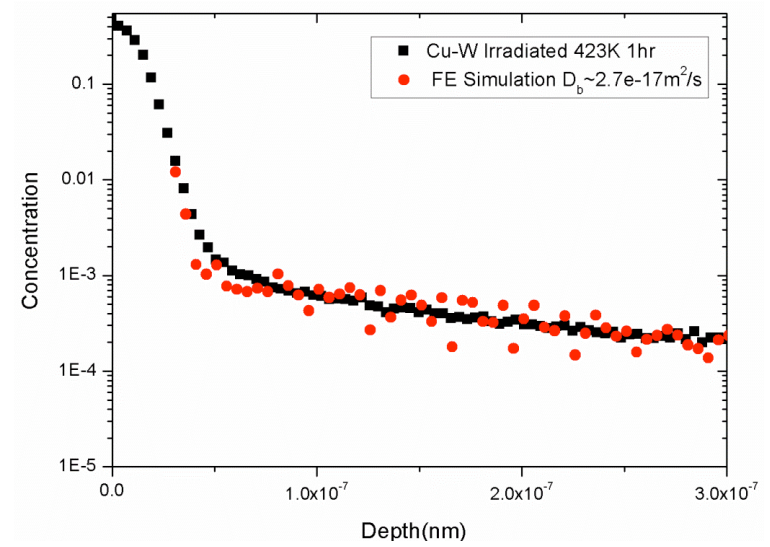
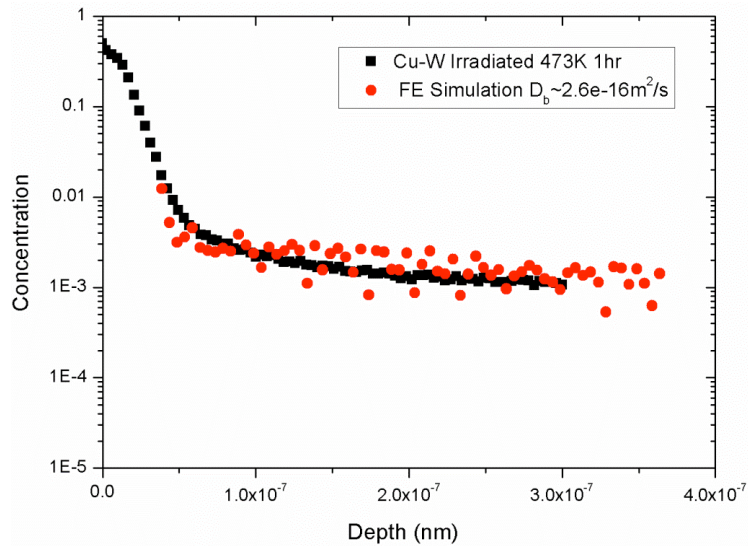
Grain boundary diffusion in thin film model:



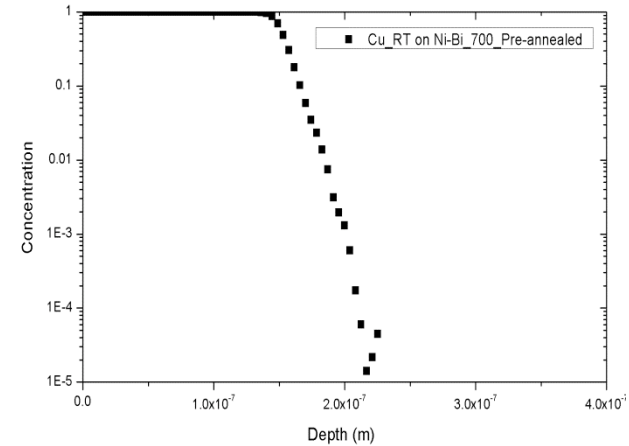
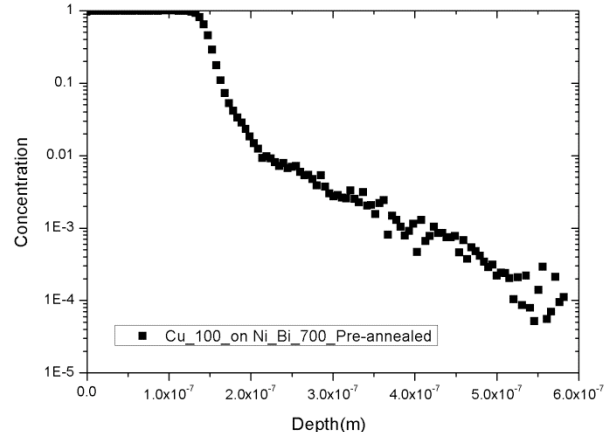
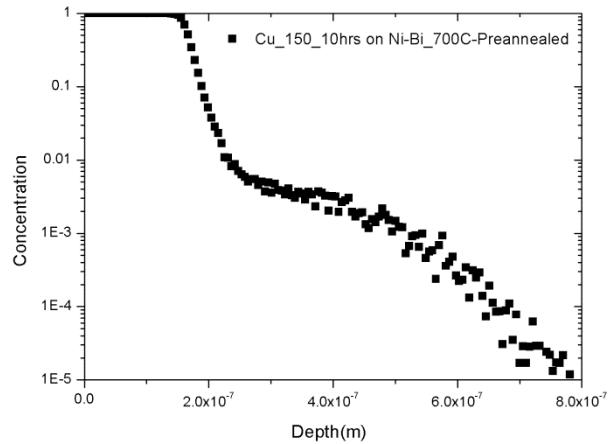
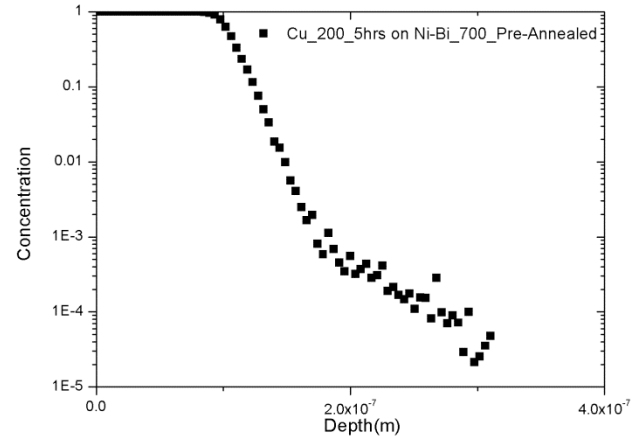
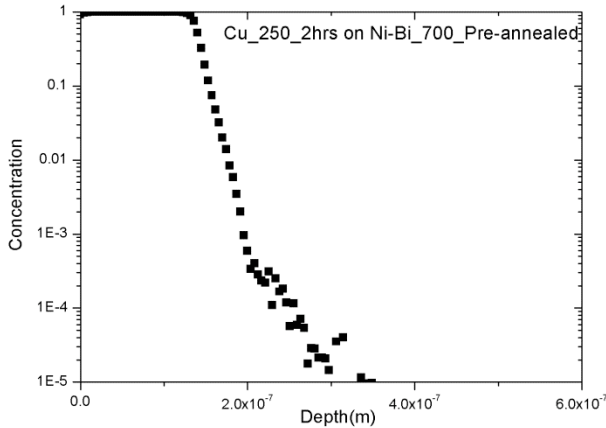
FE Simulated Diffusion Profile



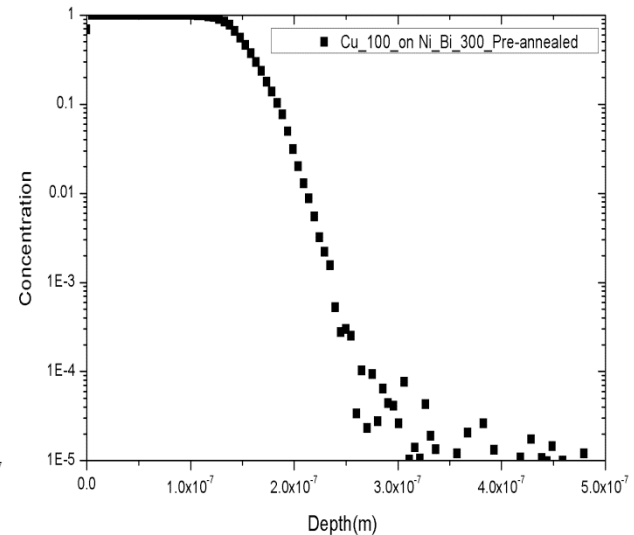
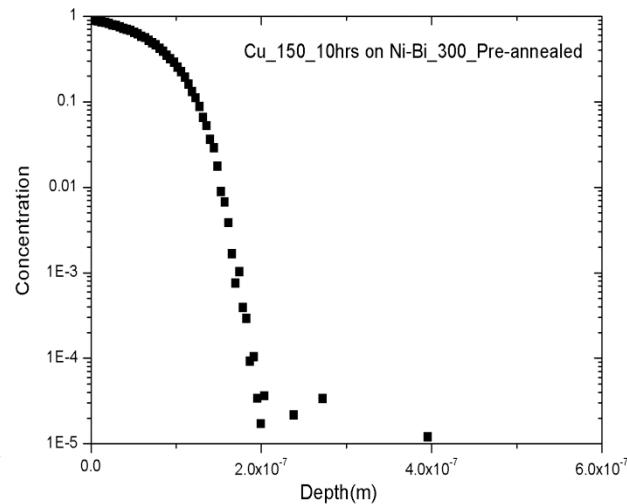
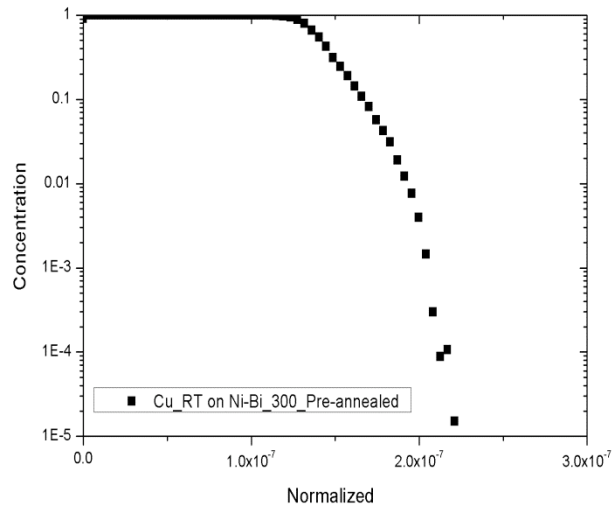
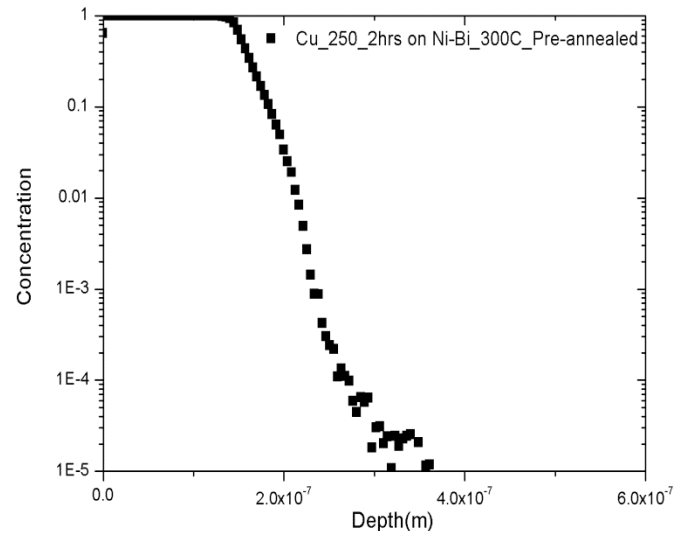
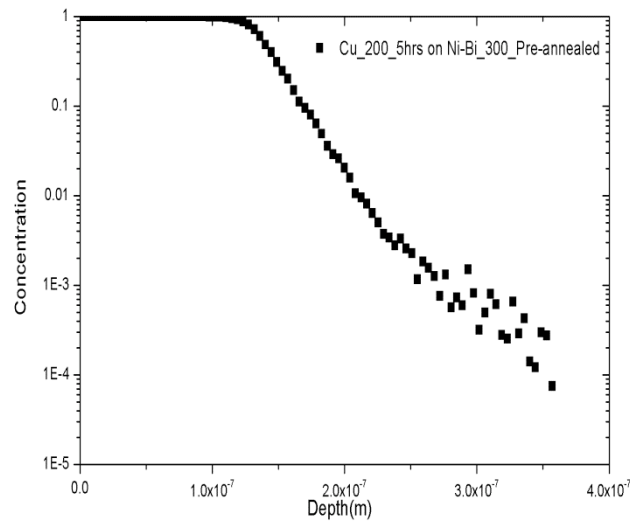
FE Simulated Diffusion Profile

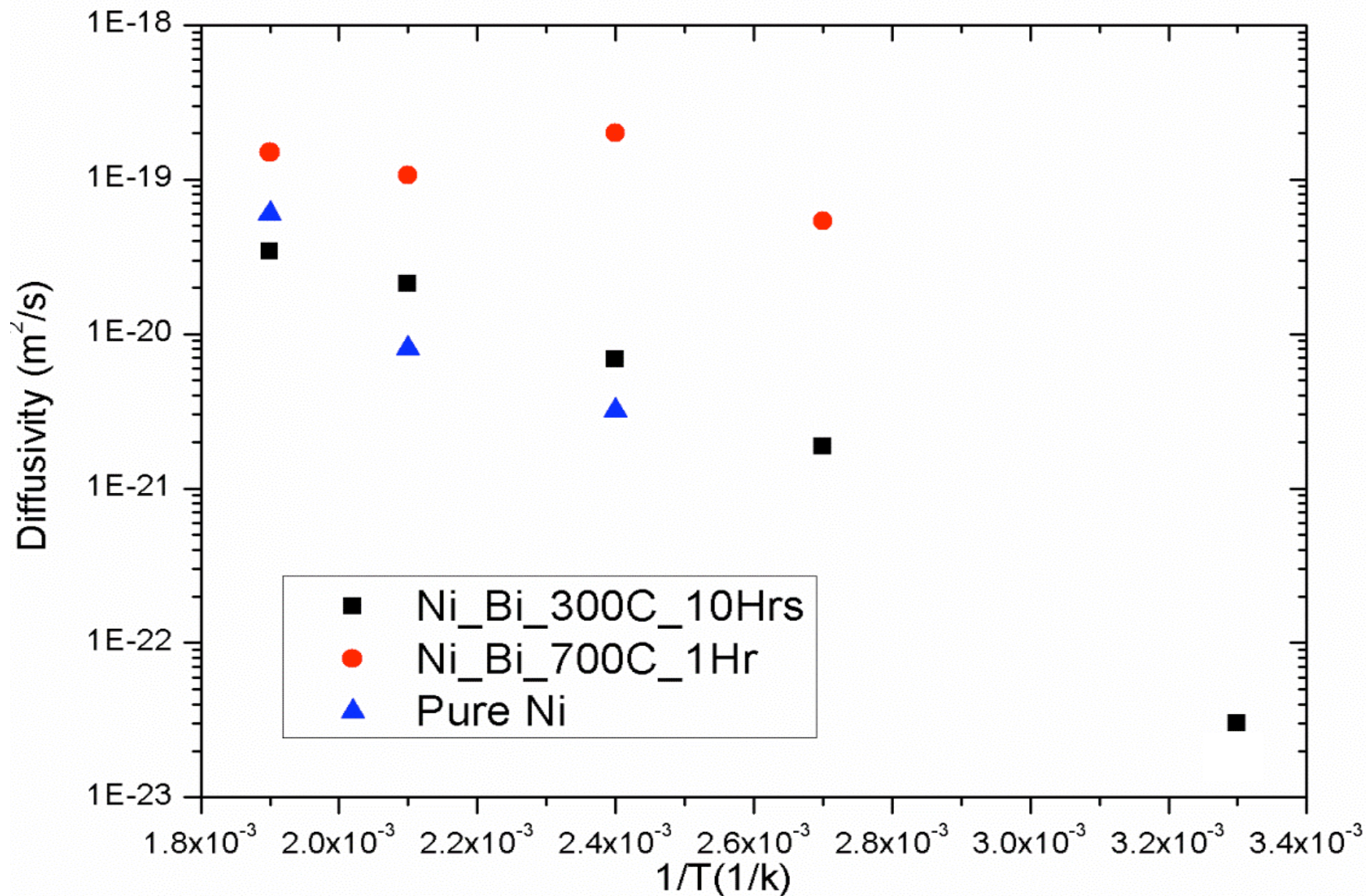


Cu diffusion into Bi doped Ni Matrix



Cu diffusion into Bi doped Ni Matrix



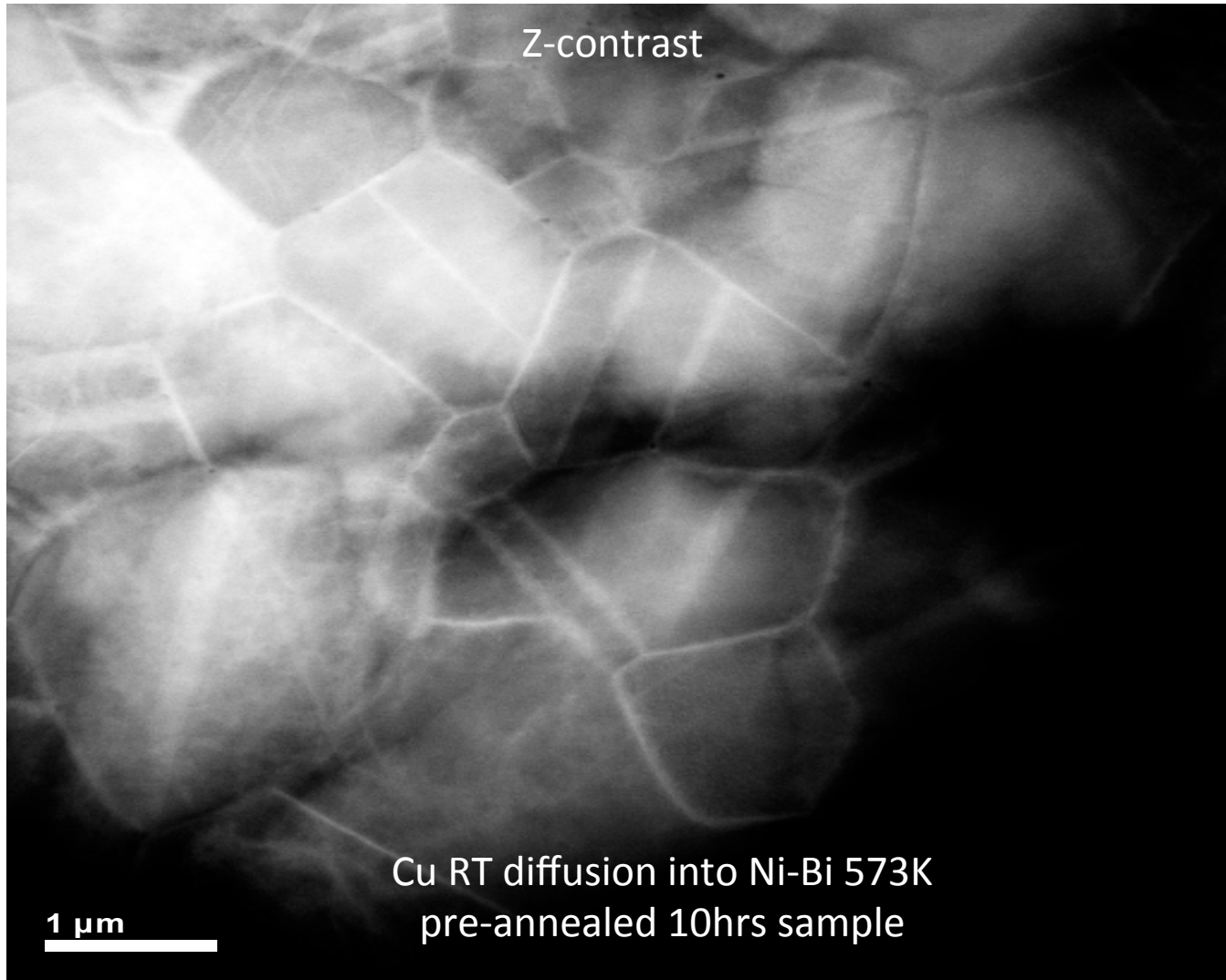


Cu diffusion into Ni and Ni-Bi (GB doped) samples

Z-contrast

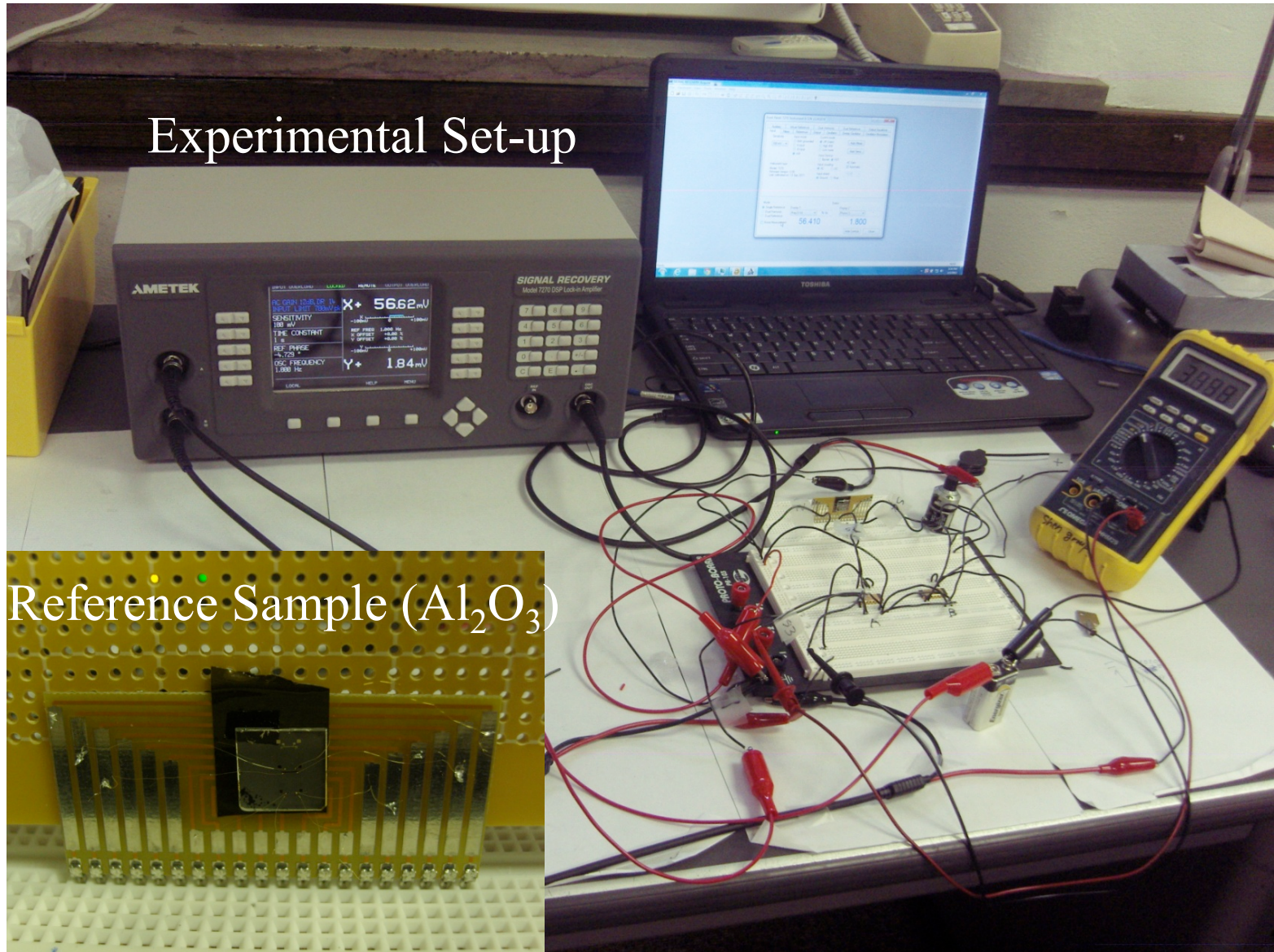
1 μm

Cu RT diffusion into Ni-Bi 573K
pre-annealed 10hrs sample



Three-Omega Thermal Conductivity Test

Experimental Set-up



Thermal Conductivity of Al_2O_3 by 3-Omega

