Grain boundary diffusion in cation-doped polycrystalline alumina

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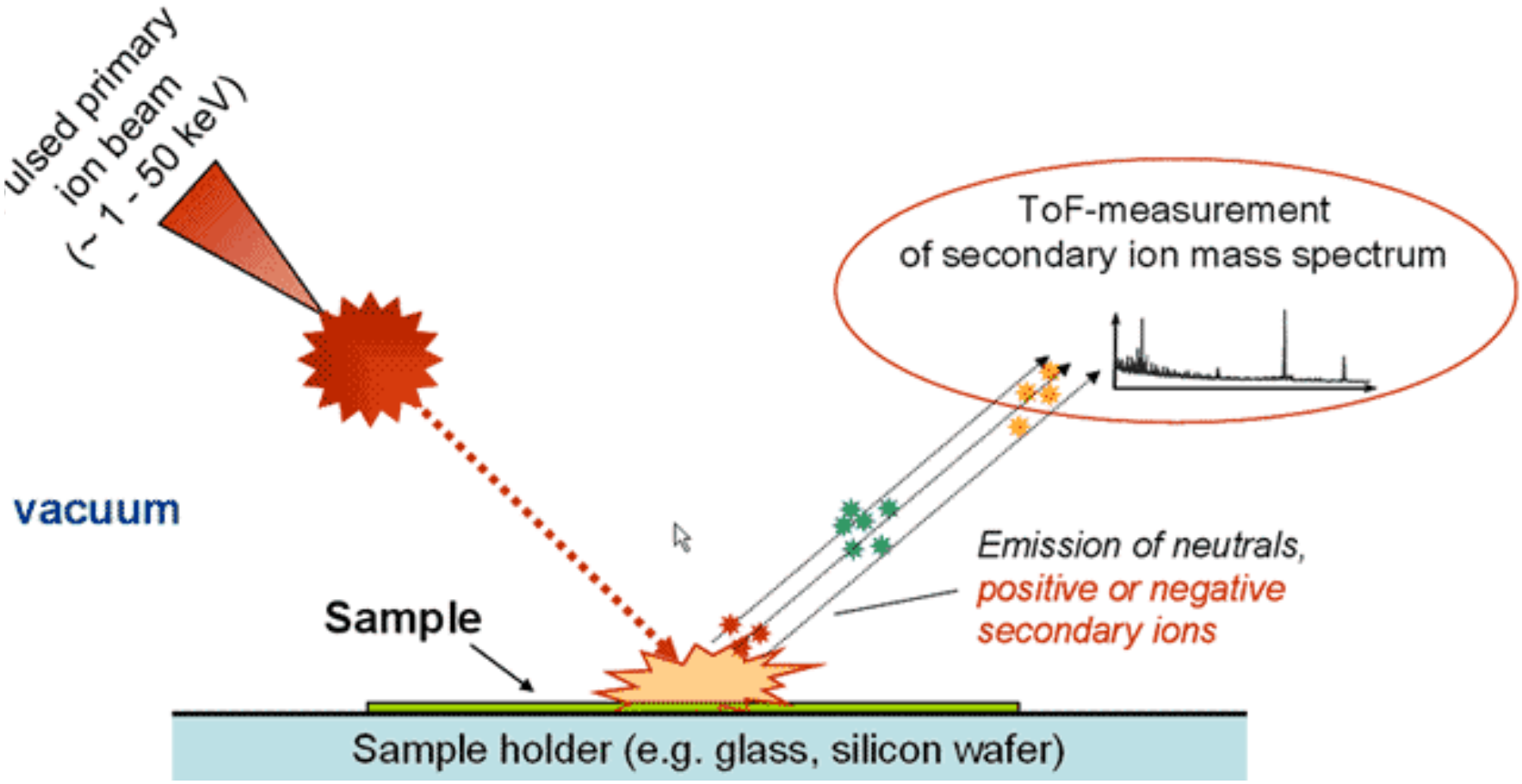
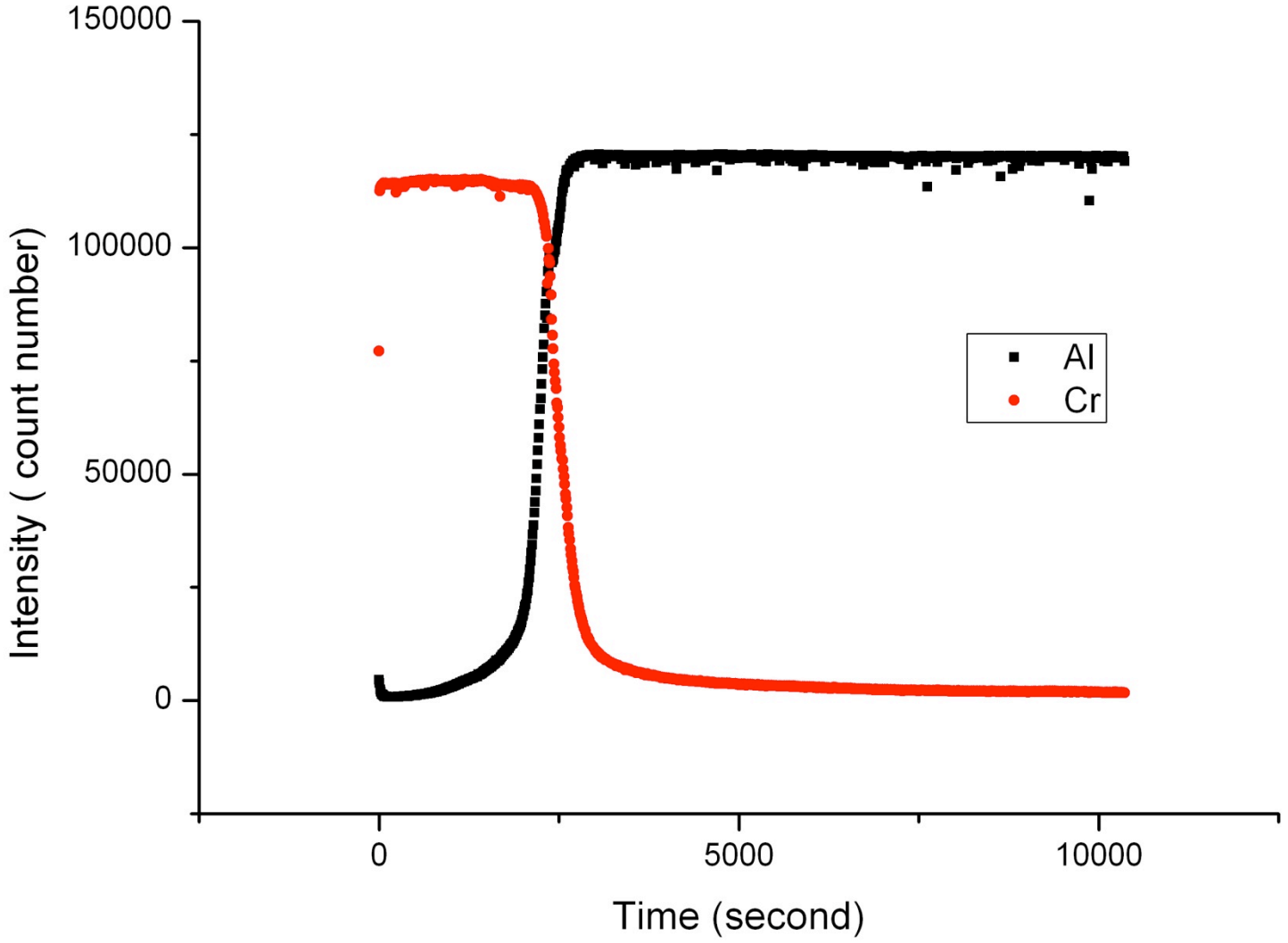
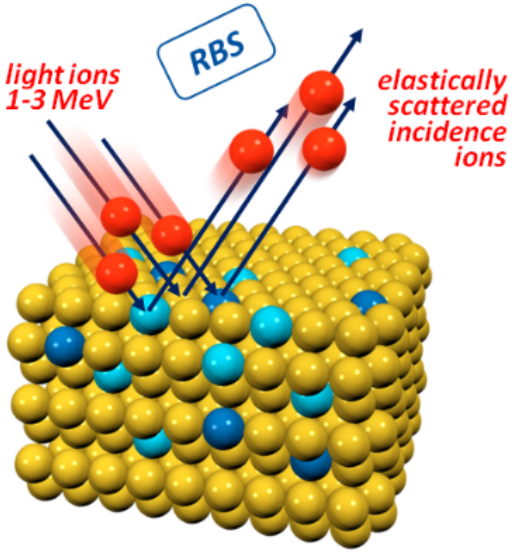
Secondary Ion Mass Spectrometry (*SIMS*)



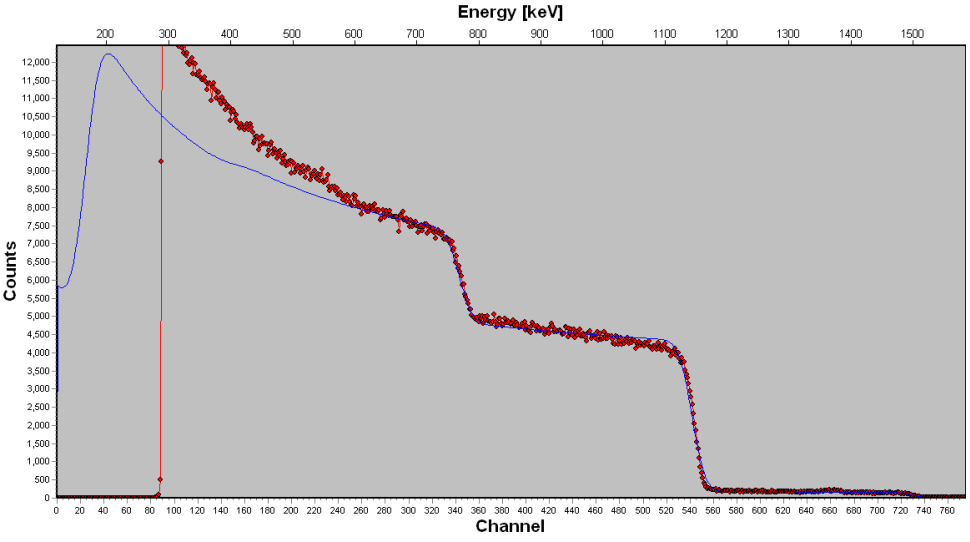
Penetration profile obtained by SIMS for chromium diffusion in alumina at T=1100℃

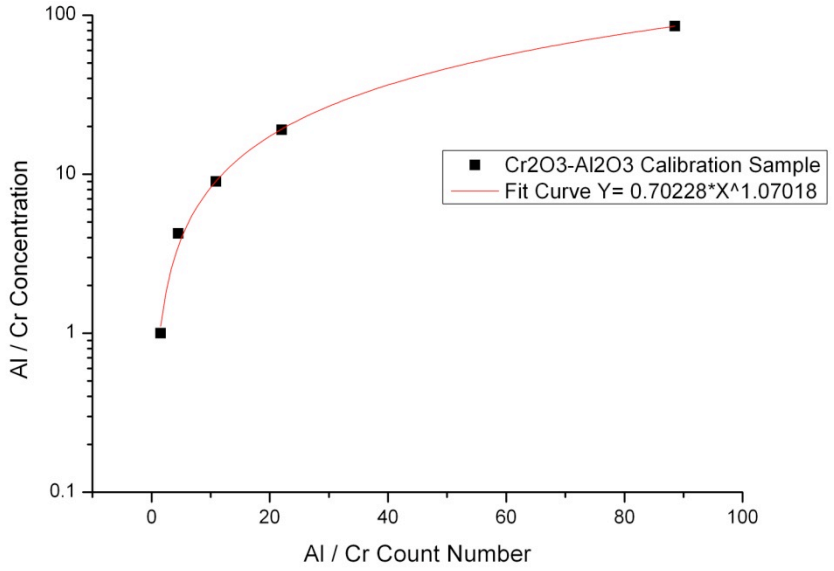


Rutherford Backscattering Spectrometry (RBS)

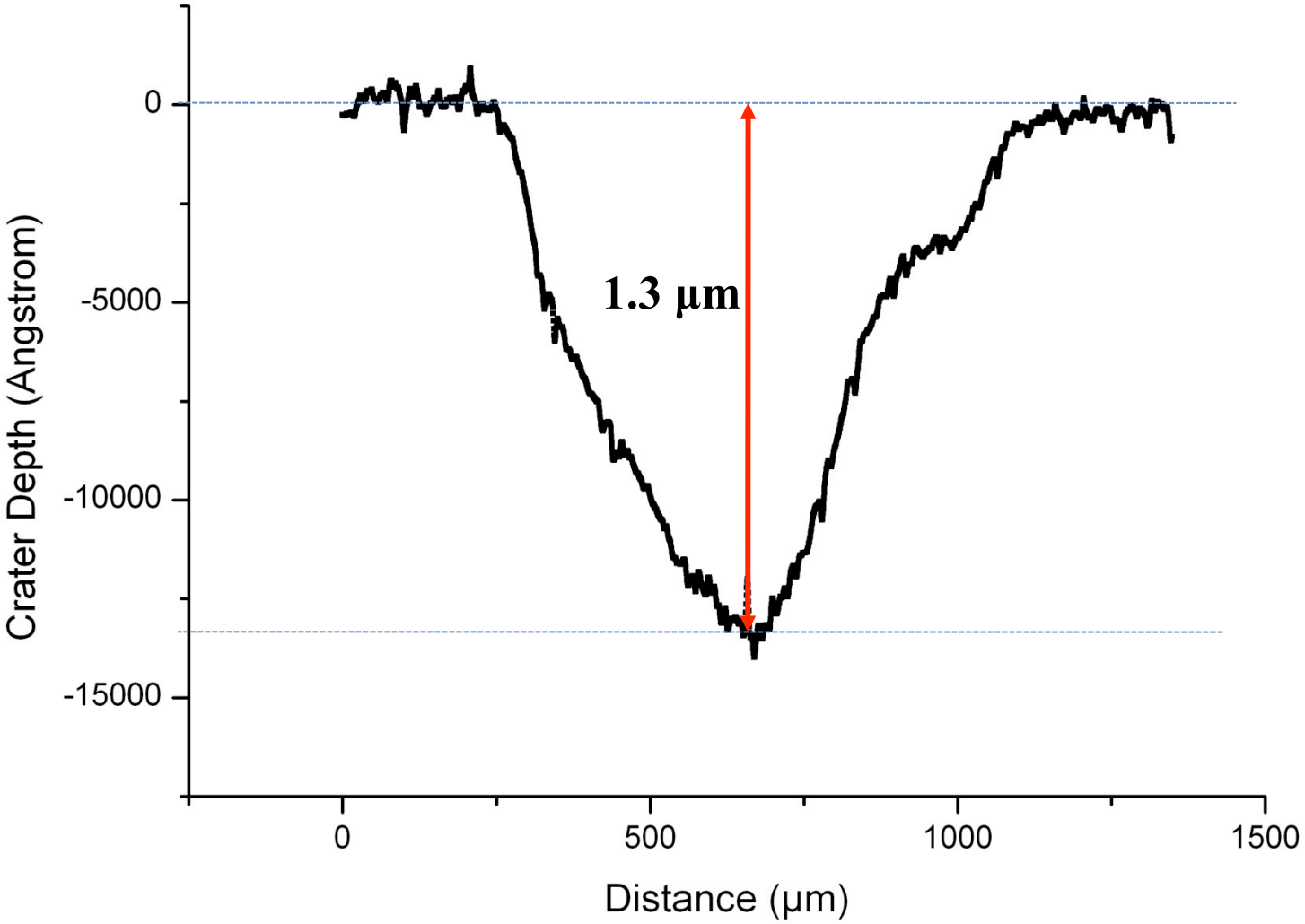


Powders are mixed homogeneously through ball milling, pressed and annealed at 1400 ℃ to reach the theoretical density





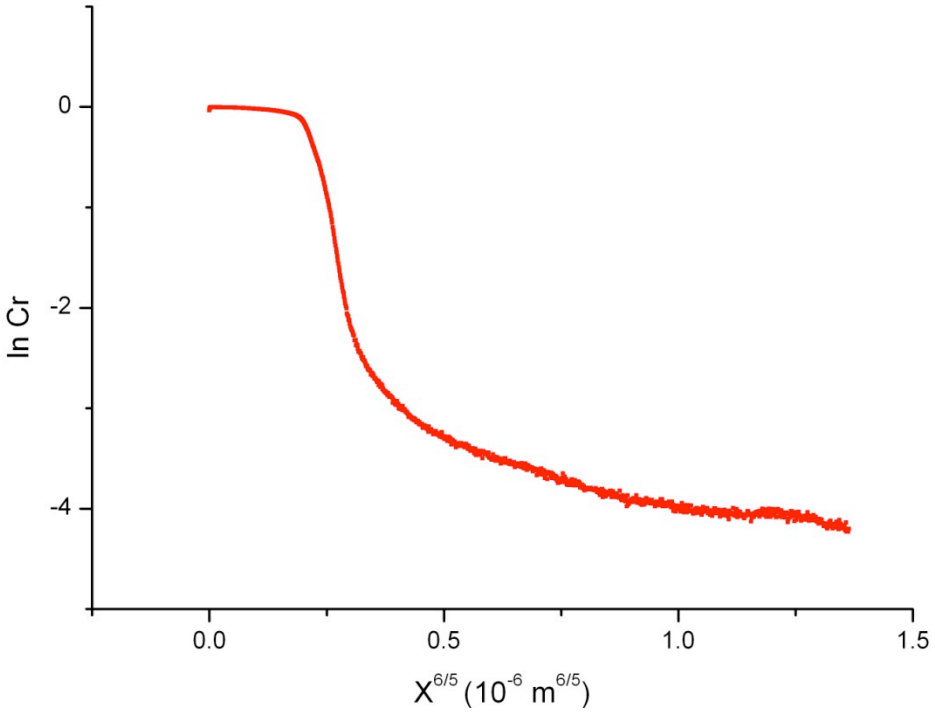
The depth of the crater, measure by profilometer



lnCr vs $X^{6/5}$ plot for Cr diffusion in undoped polycrystalline Al2O3 at 1100 for 1hr.

$$D_l = 1.2\times10^{-6}\exp\left(\frac{-290\pm30(kJ/mol)}{RT}\right)(cm^2/s)$$

$$\delta D_b = 1.32(D_l/t)^{1/2}(\partial \ln(Cr)/\partial x^{6/5})^{-5/3}$$



Undoped polycrystalline alumina	Grain boundary diffusion coefficient (cm^3/s)
*	3.81*10-21 (?)
1	
2	
3	

Work in the future

1.Work out the lattice diffusion coefficient of undoped-polycrystalline alumina through STEM equipped EDS

2. Investigate the grain boundary diffusivity of cation-doped Al2O3, characterize corresponding internal interface structure, and try to link material performance with the grain boundary diffusivity and internal interface structure.