CrO_2 thin film preparation

first results

CrO_2

- Chromium dioxide (CrO_2) is a metallic ferromagnetic oxide.
- The chromium ions are in the Cr+4 state with the electronic configuration [Ar]$3d^2$ with a magnetic moment of 2μB per ion. Theoretical calculations have predicted CrO_2 to be half metallic, with almost complete spin polarization at the Fermi level.

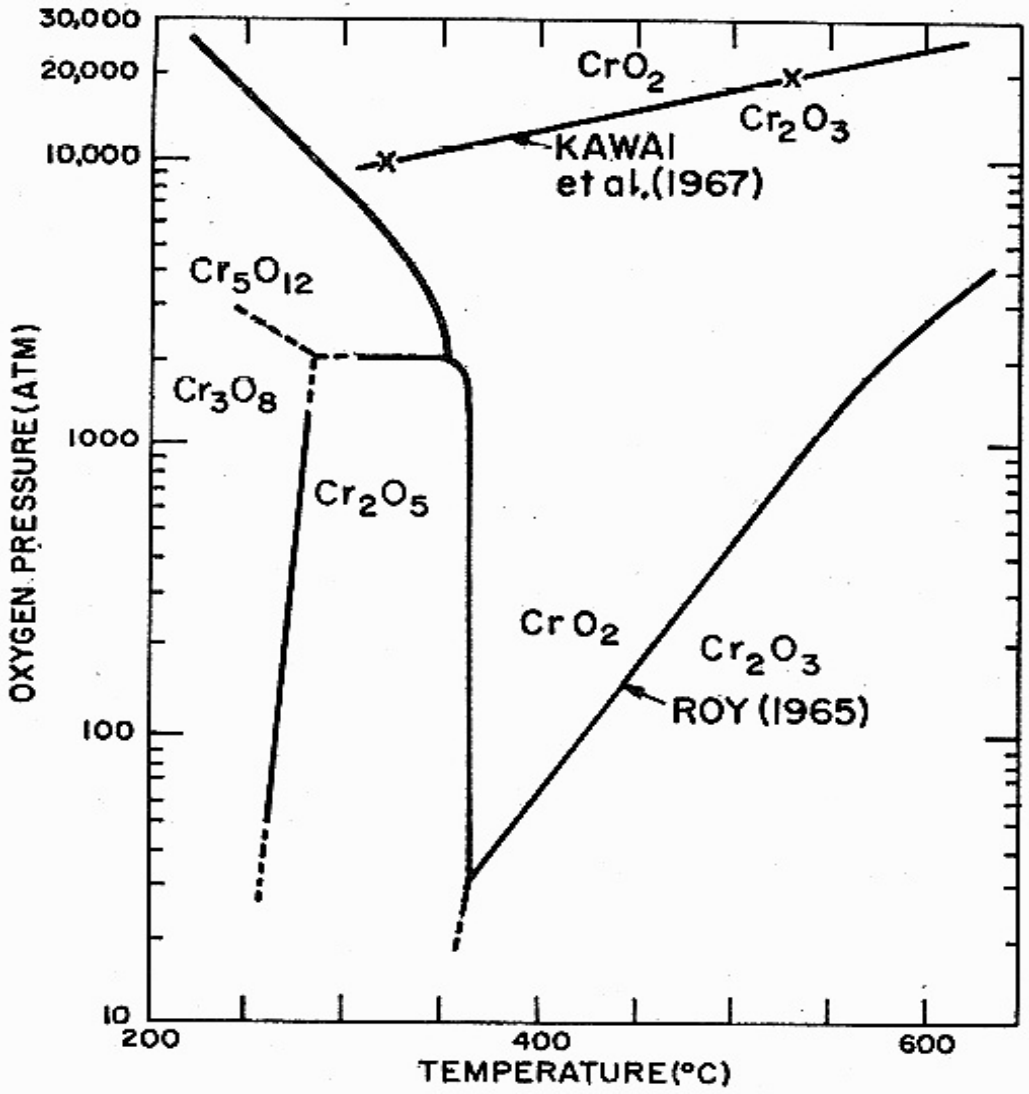
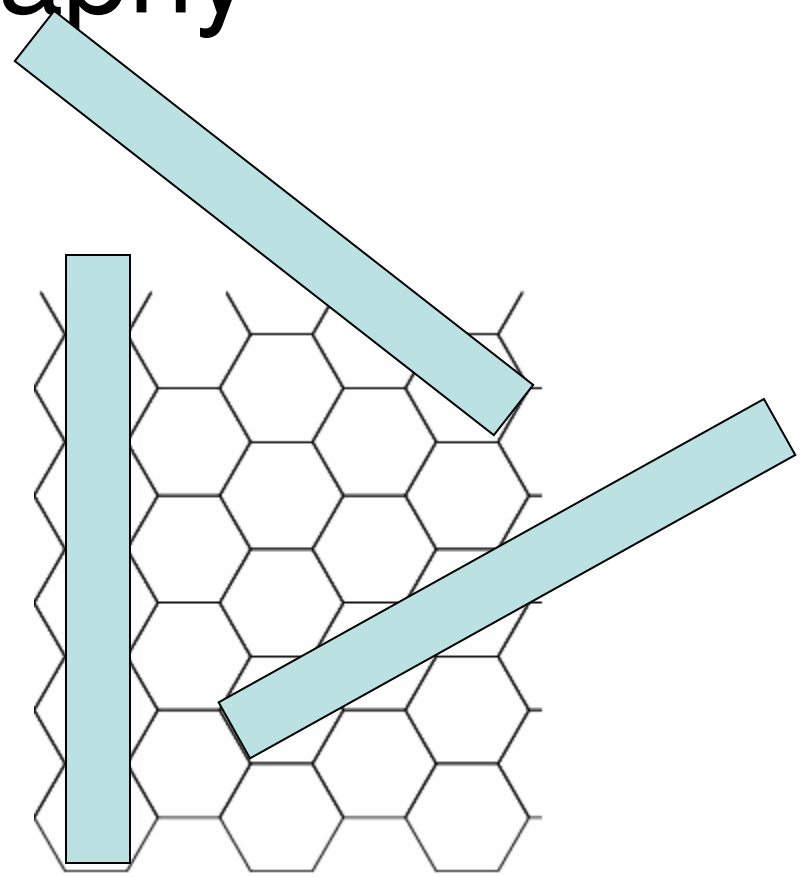


Figure 1. Phase diagram of the chromium–oxygen system

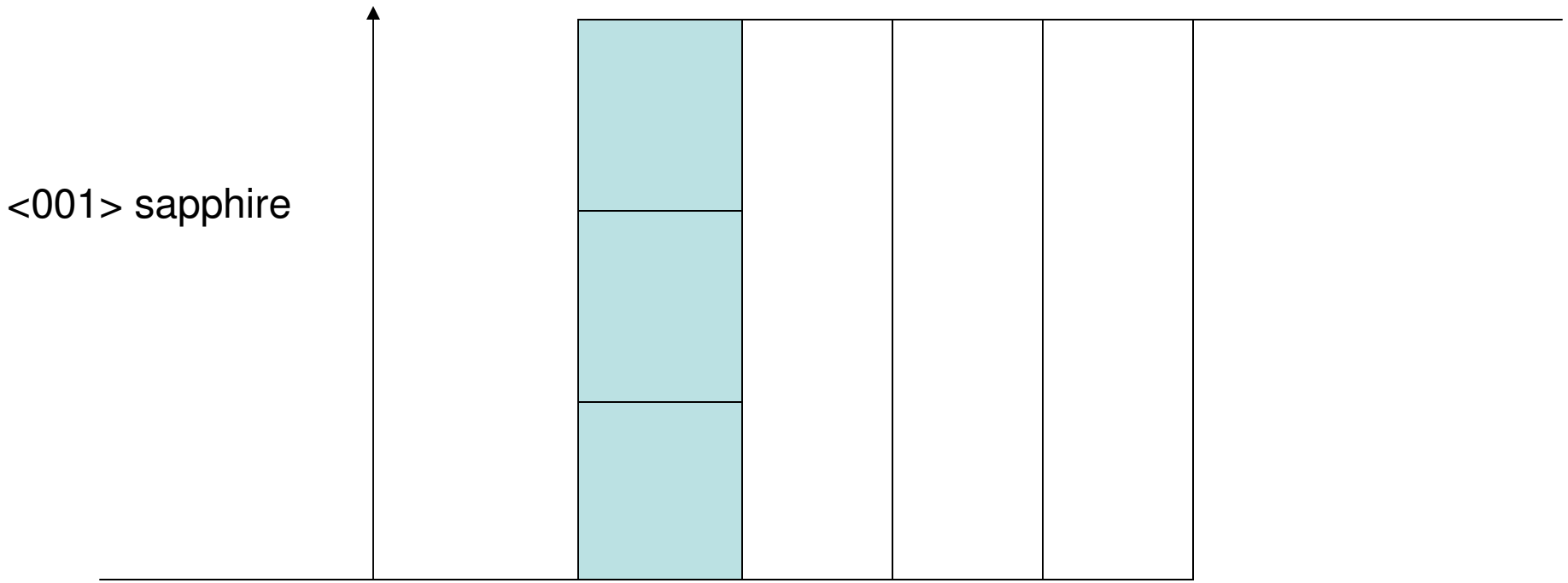
crystallography

- CrO_2 tetragonal a=0.442 nm
- c=2.912 nm
- Sapphire hexagonal a=0.448 nm
- c=1.304 nm

- <1 0 0> of CrO_2 aligned with <0 0 1> of sapphire

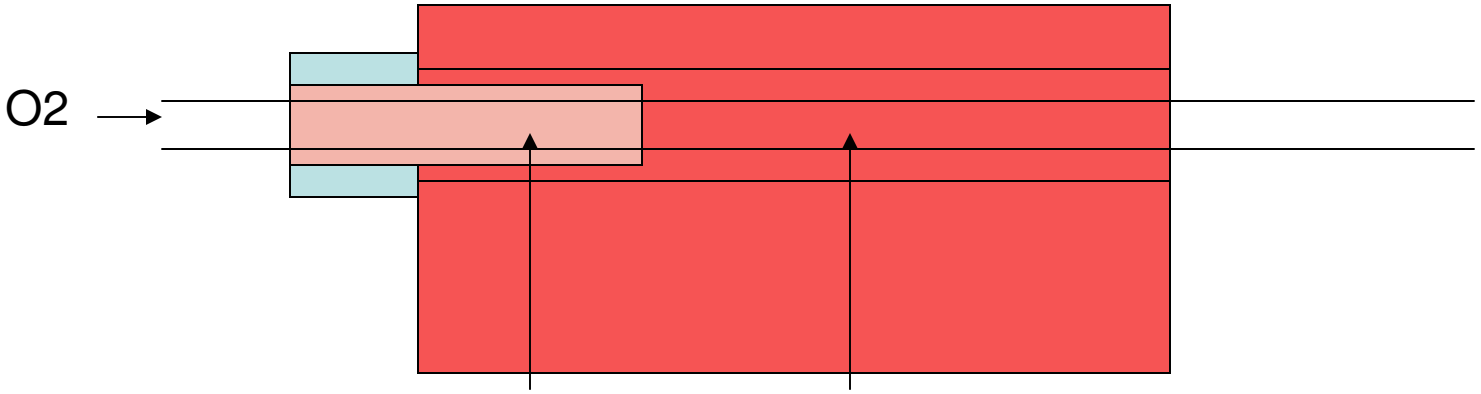


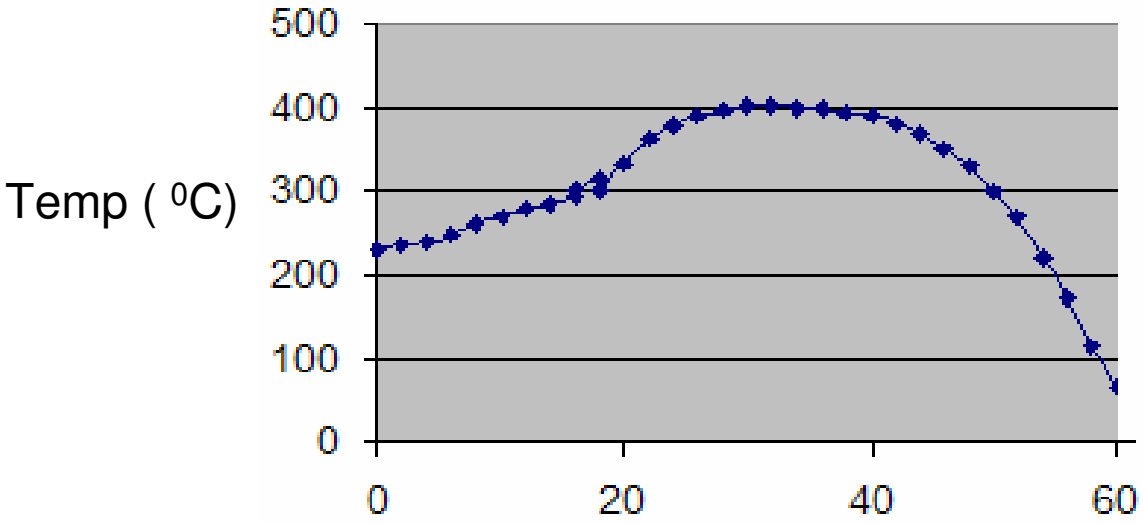
Sideview CrO2 on sapphire



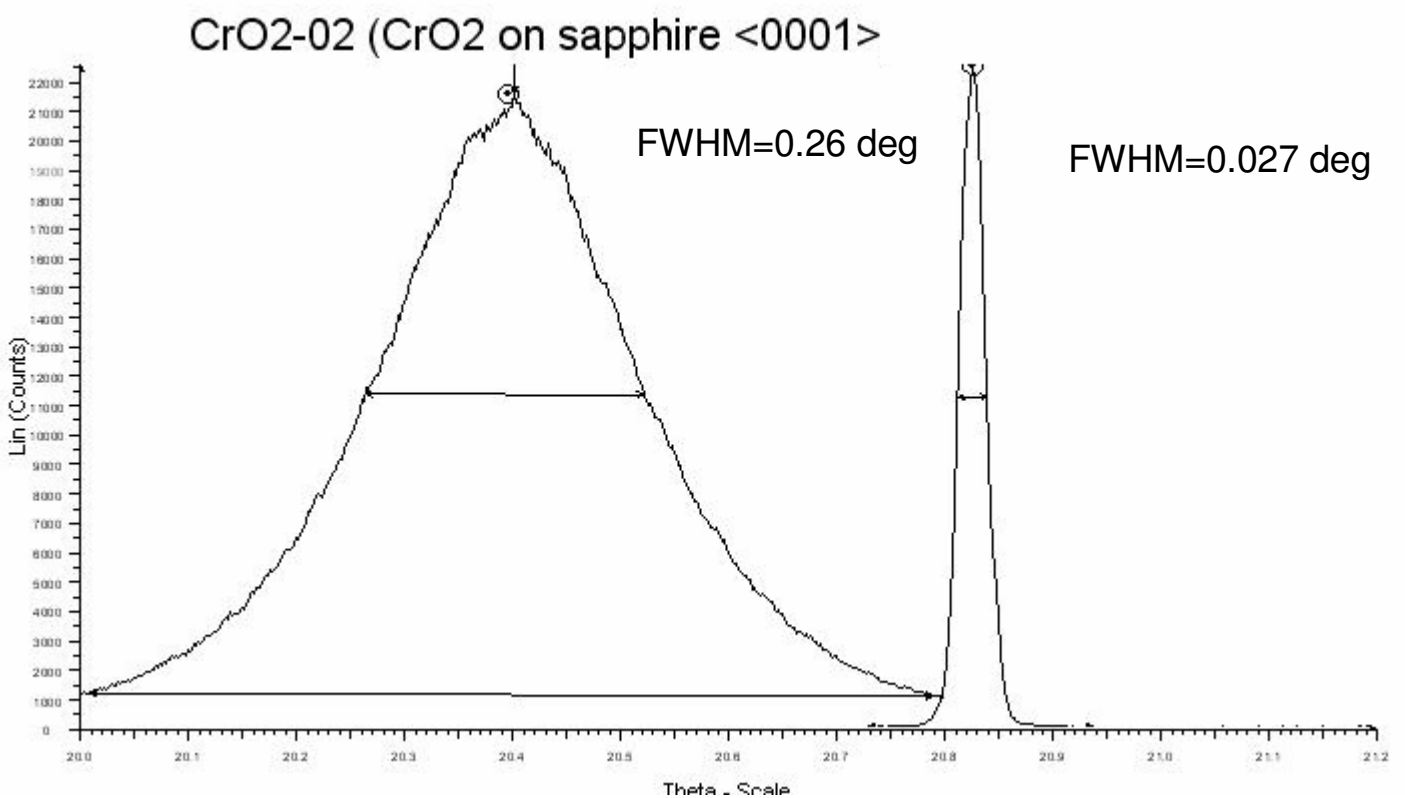
Preparation

decomposition reaction $CrO3 \rightarrow CrO2 + \frac{1}{2} O_2$

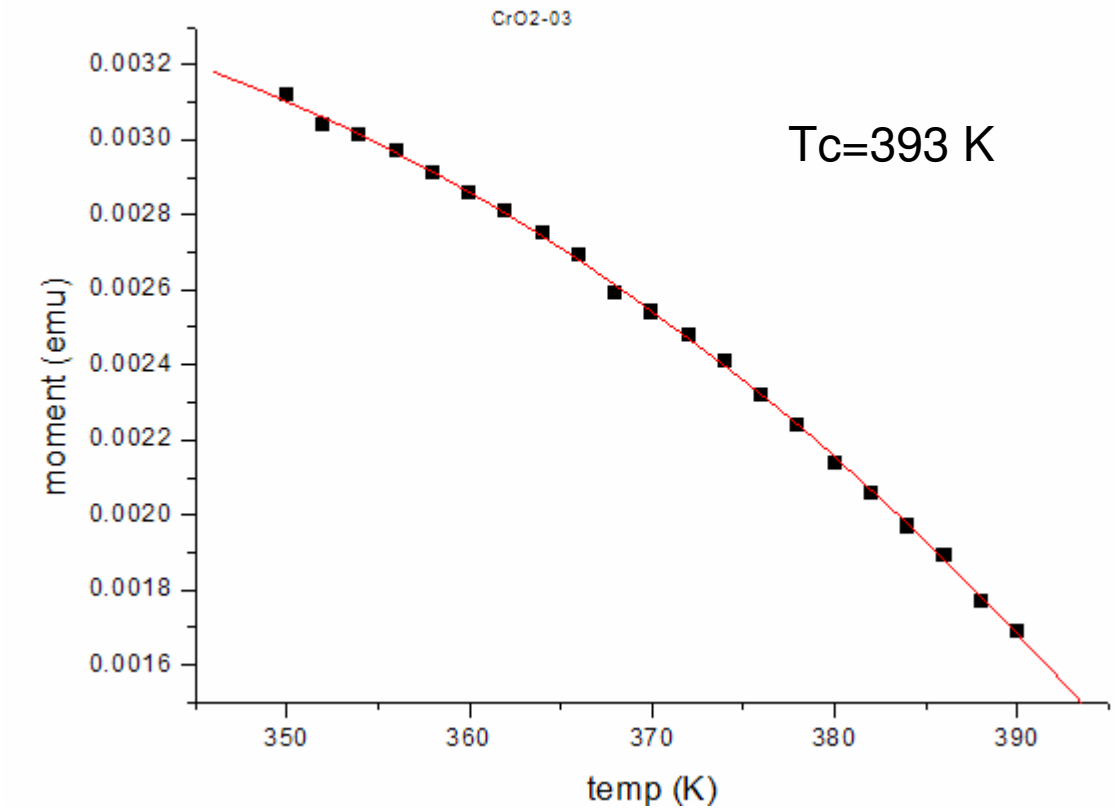




Rocking curves

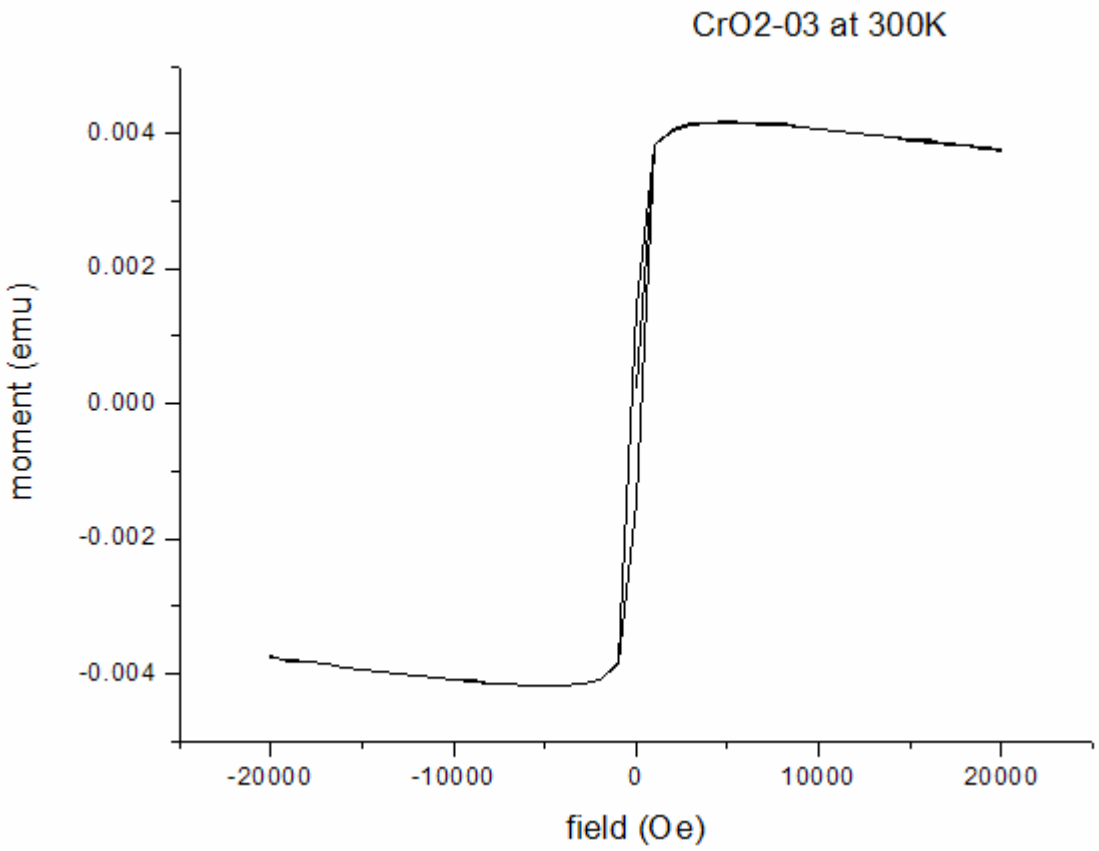


M vs T

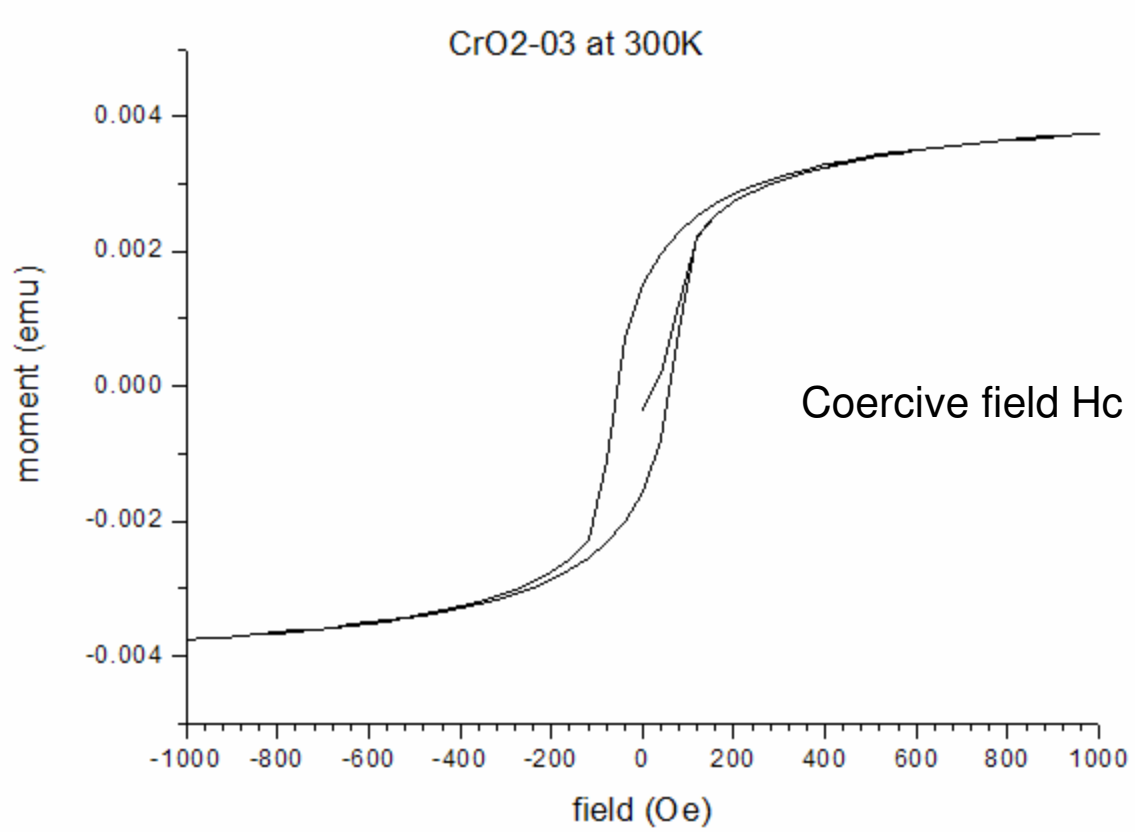

CrO2-03
0.0032
0.0030
0.0028
0.0026
0.0024
0.0022
0.0020
0.0018
0.0016
moment (emu)
350
360
370
380
390
temp (K)

Tc=393 K

M vs H at 300 K (MPMS)

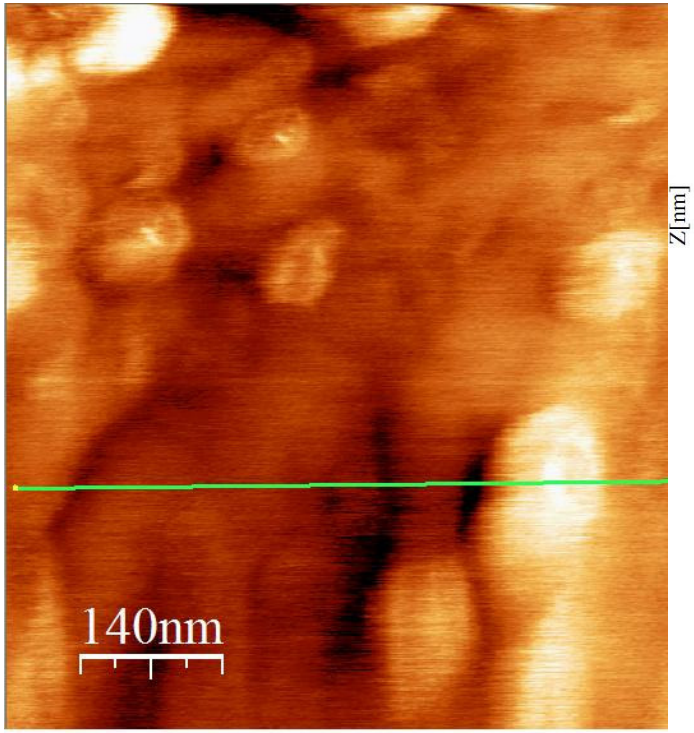


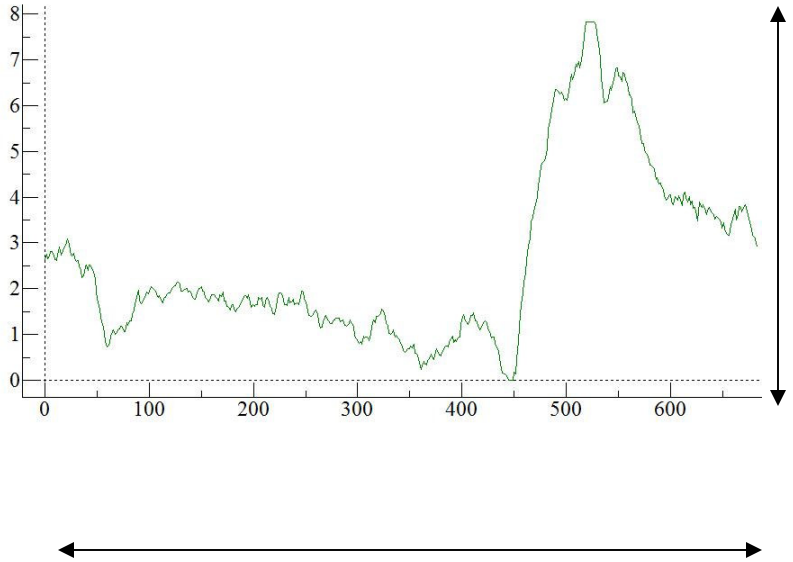
M vs H at 300K (MPMS)



Coercive field Hc ~50 Oe

AFM contact mode





8 nm

700 nm

conclusion

- It is possible to grow epitaxial films of CrO_2 with this technique

future

- Optimization / control of growth process with respect to e.g film thickness and roughness.
- Using TiO2 as a substrate instead of sapphire