Chromium Oxide Deposition by Plasma Assisted CVD Using Chromium Hexacarbonyl

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Motivation:
• Spintronics shows great potential in the information technologies including memory and logic.
• Chromium is the 1st-row Transition metal, many distinct oxides: CrO₃, Cr₂O₃, Cr₆O₁₇, Cr₅O₁₂, CrO₂, and Cr₂O₃.
• CrO₂, remarkable metallic and ferromagnetic properties, applied in magnetic recording materials.
• CrO₂, half metallicity, applied in magnetoelectronic devices requiring large spin polarization.
• CrO₂, the only stoichiometric binary oxide that is a ferromagnetic, TC=392K.

Experimental:
• PECVD, using an inductively coupled remote oxygen plasma of 20 W (13.56 MHz)
• Substrate, Si(100), Pre-oxidized at 1000°C
• Precursor, Chromium Carbonyl (Cr(CO)₆)
• Precursor vapor pressure, 0.371 torr at 24°C
• Low pressure, 1 torr; reactor base pressure at 10⁻⁷ torr
• Substrate temperature (250 – 500°C)

Results:
✓ A lattice matched substrate is required to obtain the CrO₂ phase as growth on SiO₂/Si results in the more thermodynamically stable Cr₂O₃
✓ Film formed under the conditions of the substrate temperature, 500°C > T > 250°C
✓ A growth rate decreasing with increasing temperatures suggest competing etching reactions that are promising for epitaxial and selective area growth.

Further and Current Studies:
✓ Deposition on C-plane sapphire
✓ Investigation of CrO₂Cl₂ photolysis
✓ Measure the magnetic properties
✓ Optimization of process and modeling of the film growth

Characterization:
• SEM
• AFM
• In-situ XPS
• XRD

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