CrO_2/VO_2 Rutile Oxide Heterostructures - Growth, Characterization and Device Fabrication

Chromium Dioxide (CrO_2) and Vanadium Dioxide (VO_2) are the two most well-studied rutile oxides. CrO_2 is a typical half metal and shows spin polarization of about 98% at low temperatures. These features make CrO_2 a good ferromagnetic material for GMR and TMR devices. Bulk VO_2 films present a unique metal-insulator transition (MIT) at about 68°C and thus attractive as a barrier layer for GMR/TMR heterostructures and devices.

In our recent work, rutile bilayer structures VO_2/CrO_2 have been successfully grown on both (100) and (110)-orientated titanium dioxides (TiO_2) substrates by atmosphere pressure chemical vapor deposition (APCVD) technique. Compared to the $VO_2/CrO_2/TiO_2$ (100) biayer structures, the surface of $VO_2/CrO_2/TiO_2$ (110) structures is much smoother based on Atomic Force Microscopy (AFM) results. In addition, the magnetization of CrO_2 film in (110)-orientated bilayer structure is much closer to the bulk CrO_2 films, which indicates negligible CrO_2 decomposition at the interface. The preliminary results of both surface roughness and magnetic measurements suggest that (110)-orientated TiO_2 substrate is a better choice for the growth of bilayer structures and therefore for the fabrication of GMR/TMR heterostructures and devices in the future work.