Example data from the EMSL/ASTM Tools for Surface Analysis webpage:

www.emsl.pnl.gov/capabilities/spectroscopy/surface_analysis

Because of the increasing technological importance of oxide films for a variety of applications, there is a growing interest in knowing the sputter rates for a wide variety of oxides. To support needs of users of the Environmental Molecular Sciences Laboratory (EMSL) User facility as well as our research programs, a series of measurements have been made of the sputter rates for oxide films that have been grown by oxygen plasma assisted molecular beam epitaxy, pulsed laser deposition, atomic layer deposition, electrochemical oxidation, or sputter deposition. The sputter rates for these oxide films were determined in comparison to those for thermally grown SiO_2, a common sputter rate reference material. The film thicknesses and densities for most of these films were measured using x-ray reflectivity (XRR). These samples were mounted in an x-ray photoelectron spectroscopy (XPS) system or an Auger electron spectrometer for sputtering measurements using argon ion sputtering. Materials examined include: SiO_2 (reference films), Al_2O_3, CeO_2, Cr_2O_3, Fe_2O_3, HfO_2, ITO (In-Sn-oxide), Ta_2O_5, TiO_2 (anatase, rutile and amorphous) and ZnO. We find that the sputter rates for the oxides can vary up to a factor of two (usually slower) from that observed for SiO_2. The ratios of sputter rates relative to those of SiO_2 appear to be relatively independent of ion beam energy for the range of 1kV to 4 kV and for incident angles of less than 50°.

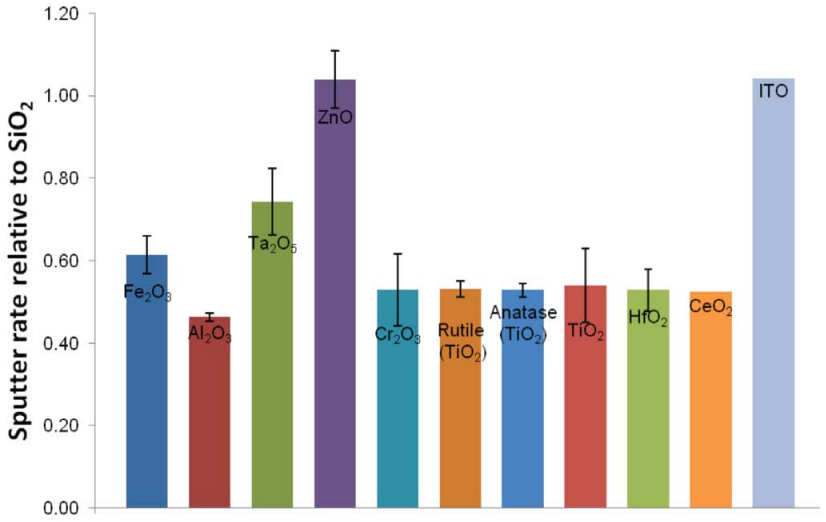

Figure Caption - Sputter rates of eleven metal oxides (in different thin film forms) relative to that of thermally grown SiO_2 films. Where multiple measurements or multiple films were examined the mean of measurements are reported and the error bars show the 95% confidence limits for the value of the mean. For full details see D. R. Baer, M. H. Engelhard, A. S. Lea, P. Nachimuthu, T. C. Droubay, J. Kin, B. Lee, C. Mathews, R. L. Opila, L. V. Saraf, W. F. Stickle, R. M. Wallace, B. S. Wright, "Comparison of the sputter rates of oxides films relative to the sputter rate of SiO_2", *Journal of Vacuum Science and Technology* A 28(5) (2010) pp1060-72, DOI:10.1116/1.3456123.