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Argon Cluster XPS Depth Profiling of Metal Oxide Thin Films

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In XPS, argon gas cluster ion beams (GCIB) are an exciting new tool for sputter etching and depth profiling of materials. However, little is currently known of their effectiveness in reducing preferential sputtering compared to monatomic argon bombardment for many technologically important inorganic compounds. In this work, XPS depth profiles through various metal oxide thin films using monatomic and cluster beams using different GCIB parameters will be presented. Comparisons will be made between preferential sputtering and other important depth profiling parameters using argon monatomic and cluster beams. It will be shown that the response of the material and quality of the GCIB depth profiles is strongly dependent of the GCIB parameters. Using specific experimental conditions, the degree of preferential sputtering for all of the metal oxides studied could be reduced or eradicated using the argon GCIB compared to the monatomic source. Molecular dynamic simulations of cluster impacts will be employed to inform the discussion of the results.

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