Quantitative Measurements of Elemental Intermixing in Nanoscaled Multilayers

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With the current international focus on nano-materials, the study of multilayered materials has been the subject of intense investigation in the recent past. Of critical importance to the behavior of these types of materials is the structure of the interfaces between the layers. “Structure” here includes the nature of the interfaces, the defect structure associated with the interfaces, and the compositional intermixing on either side of the interfaces. While much effort has been placed on growth of these types of materials, the characterization of the interfaces has not received the same degree of attention. This is mainly because the development of tools for such characterization was in its infancy. The recent availability of new instruments, namely aberration-corrected (scanning) transmission electron microscopes ((S)TEM, and the tomographical atom probe (TAP), has permitted detailed observations of the interfaces in these materials to be made. This paper will present the results of a study of the study of interfaces in both metallic multilayers and in perovskite-based multilayers. This study has involved the application of the FEI Titan 80-300 probe-corrected (S)TEM, using both EDS and EELS, and the Imago LEAP atom probe, such that independently corroborated measurements of compositional differences about these interfaces have been undertaken.