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On the plasmon contribution to X-ray electron emission spectroscopy background:q-statistical analysis

Abstract: A baseline approximation is essential for a qualitative and quantitative analysis of XPS data, especially if several components interfere in one spectrum. Despite the success of the Shirley, method, it does not still solve the plasmon contribution to the background, and there is still a debate about the contribution of intrinsic and extrinsic plasmons in XPS spectra. In this paper I am presenting a new, experiment-based understanding of X-ray plasmon creation in solids shirely baseline methodology. While the photoelectron on its journey to the surface can excite extrinsic plasmons at a well-defined energy loss, it can also lose "unquantized" energy by electron-electron and electron-ion collisions, thus contributing to a featureless smooth background in the X-ray Photoelectron Spectra (XPS).

As the plasmon energy loss peak spectrum decays exponentially from the 1st loss to the higher orders, the deviation from Tsallis exponential statistics in plasmon energy loss peak decay may be interpreted by the long-range interaction through the Tsallis parameter q, and can be utilized accordingly to estimate the unquantized plasmon contribution to the background. In this paper, the q-Tsallis exponential function has been used to analyze the decay of energy loss peaks from the first order to the highest orders. In addition, the deviation factor q-Tsallis has been determined and integrated into the Shirley baseline formula. Besides a q-Tsallis-modified Shirley formula was proposed, the unquantized contribution of energy loss plasmons to the background has also been estimated.

Keywords: Shirely baseline, X-ray Plasmon, Extrinsic, Intrinsic, XPS, EELS.

Biography: Graduated from the University of Bahrain in 1999 with a BSc in Physics, and pursued his graduate studies at Kyoto University to have his MEng, and PhD in Materials Science and Engineering in 1999. Worked on X-ray Surface analysis techniques including XRR, XRD, XRF, XPS, and EELS in the total reflection condtion. Has experience in industrial research consultancy in broad themes in Japan, and currently engaged in energy materials and Beyond-Li ion battery research.