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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.

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The sustainability of beach-cast seaweed biomass for biorefinery processes: calorific power heating studies with macroalgae

Abstract: Alternative renewable energy technologies offer the opportunity to move towards more sustainable systems in which natural resources are conserved through their own perennial cycles. Macroalgae as a marine substrate for the biomass energy sector is a natural resource of inexhaustible abundance in the oceans, growing three to four times longer than terrestrial plants. The aim of this work was to assess the sustainability of macroalgal biomass for biorefinery processes. Two studies were therefore carried out. In the first, the natural deposition of macroalgae was evaluated in 28 collections carried out in seven beaches on the Maceió coast over a period of 2 years. Samples were taken using the zigzag method and covered a deposition area of 135,000 m². The results obtained of 5.08 tons/ha for dry biomass by daily collection means that it is the only type of biomass that can be collected daily, with an efficiency 35 times greater than sugarcane biomass production. The second study evaluated the calorific value of the biomass and, as a result, the low calorific value of 8.82 MJ/kg in 13 species analysed was similar to the main biomass used in Brazil, sugarcane bagasse, evaluated at 8,91 MJ/kg. Aggregated macroalgae biomass in condensed pellets as energetic composites, obtained a value of 20.19 MJ/Kg, 11.46% more than the average of terrestrial biomass pellets with an average of 17.61 MJ/Kg. Based on the results obtained, it is observed that macroalgae biomass has potential for biorefinery.

Key words: biomass, coral reefs, energy, sampling studies, seaweed, sustainability.