Spatial Resolution of EDS Measurements

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The spatial resolution of energy dispersive X-ray analysis (EDX) in Scanning Electron Microscope (SEM) is defined as the minimum distance between two different areas, with different compositions, which can be measured without being influenced by the composition of the other area and it is mainly determined by the size of the teardrop shaped interaction volume within the sample.
The spatial resolution of EDX is investigated by doing line scans across bi-crystals, formed by two adjacent crystals of different compositions, with sharp boundary between the two crystals while the line scan is starting from one material and ending in the second.
Since the spatial resolution is limited by the interaction volume size, it is then influenced by the latter changing based on the of the two members of the bi-crystal which is within the interaction volume. Successively, the x-ray intensity changes along the line scan according to the atomic number of the elements which are within the interaction volume.
In order to investigate the spatial resolution of EDX in a SEM, it has been used different sample materials and thicknesses and different acceleration voltages and probe sizes to investigate the impact of these parameters on the spatial resolution values.
The sample material used: silicon-platinum bi-crystal (Si/Pt) with a big difference in the atomic number, copper-tin bi-crystal (Cu/Sn) of a smaller atomic number difference and eventually microcline-albite bi-crystal (Mc/Ab) with the smallest average atomic number contrast between the two crystals.
The SEM measurements are done for different thicknesses for each sample: bulk with a thickness of micrometers and lamella with nanometers thick, with a 10 nm beam and acceleration voltages of 30, 20, 10 and 5 KeV.
Afterwards, Monte-Carlo Simulations (CASINO) are performed to interpret the previous results and investigate the interaction between the electron beam and the Si/Pt sample, reflecting the dependence of the spatial resolution on the sample material, thickness (lamella/ bulk) and the accelerating voltages.

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