EBSD Limitation for Phase Identifications

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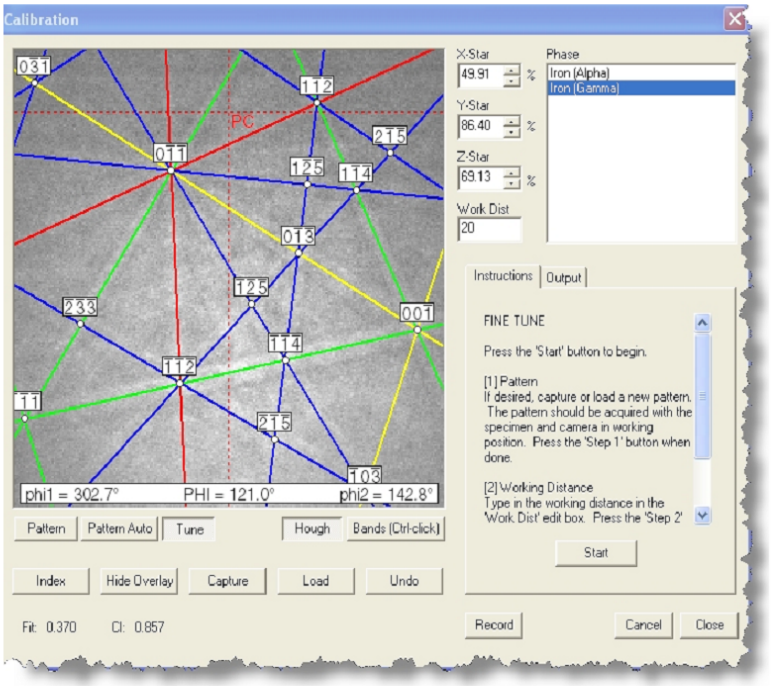
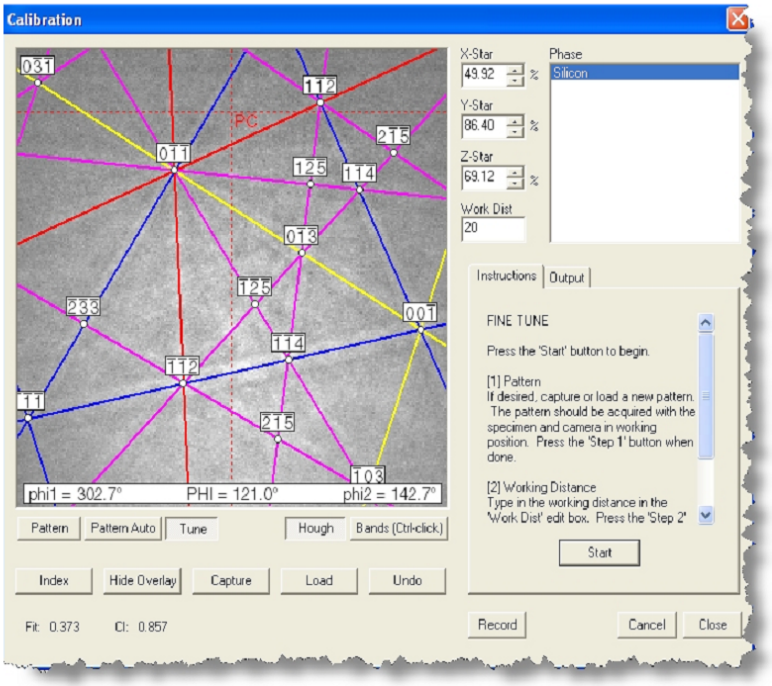
EBSD auto indexing for the crystallography (structure) is by using EBSD pattern symmetry (through Hough Transform), rather than by band widths on the pattern. Therefore if 2 phases have the same crystallographic symmetry, even with quite large lattice parameter differences, EBSD auto indexing could not fully distinguish these 2 phases.

The below EBSD pattern was obtained from Si wafer at the EM Lab Zeiss SEM, and it was indexed well by Si phase (m3m) with 86% confidence index. However, if using the same symmetry γ-Fe (m3m), the indexing result was exactly the same as shown in below figures, even though there are about 30% lattice parameter differences (γ-Fe, a = 0.365 and Si, a = 0.543 nm). As could be expected, Al phase (m3m, a = 0.404 nm) is also in the same regime.

If the sample contains Fe, Al and Si phases, the different phases could not be identified by EBSD alone. However, there is a possible solution with the combination EBSD and EDS (chemistry) analysis, simultaneously.



EBSD indexing by using
γ-Fe (Cubic, m3m, a = 0.365 nm)



EBSD indexing by using
Si (Cubic, m3m, a = 0.543 nm)