Electron Backscatter Diffraction (EBSD)

Latest Innovation in our FE SEMs

SMART – POWERFUL – FLEXIBLE

Electron Backscatter Diffraction (EBSD) is a powerful technique capable of characterizing extremely fine grained microstructures in a Scanning Electron Microscope (SEM). Electron Backscatter Patterns (EBSPs) are generated near the sample surface, typically from a depth in the range 10 – 50nm. In order to achieve effective analysis it is imperative to combine high beam current with small probe size to achieve high spatial resolution in a time efficient manner. The general setup for EBSD is shown in Fig. 1.

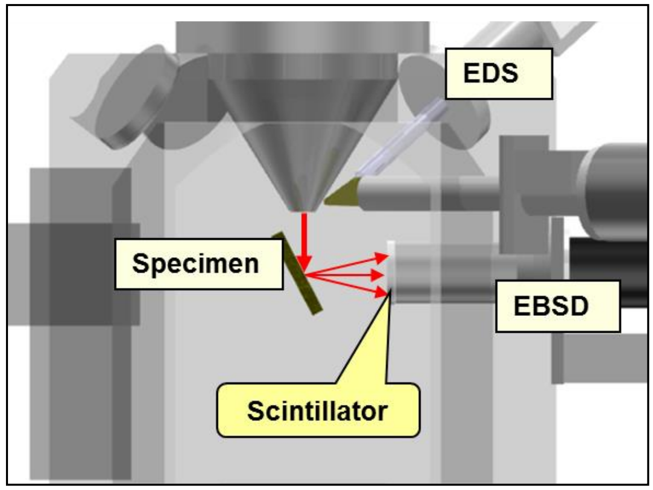

Figure 1. General setup for EBSD in FE-SEM

JEOL's JSM-7900F is a newly developed extreme high resolution system that features all the previous benefits of a JEOL FE-SEM, including aperture angle control lens (maintains minimum spot size even at very high beam currents) and specimen bias function for improved resolution at low kV. The system has also brand new design components that provide extreme resolution at all kVs – the super hybrid lens (combination electrostatic and electromagnetic) as well as new suite of in-column detectors that allow signal filtering. These features contribute to the ability to perform both imaging and analytical work at very high spatial resolution. Fig. 2 shows an example of Pt film with grain size of ~ 20-100 nm analyzed by EBSD.

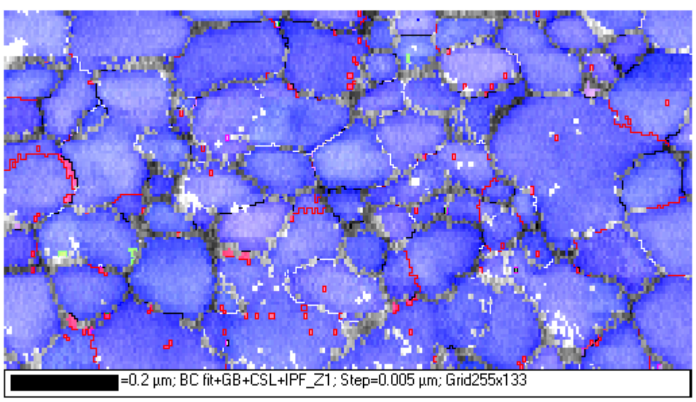

Figure 2. EBSD map (IPF) of Pt film, collected with Oxford HKL system.

The super hybrid lens design allows observation of any type of sample (even highly magnetic specimens) without any pattern distortion. Fig. 3 shows a sample of neodymium sintered magnet ($Nd_2Fe_{14}B$) IPF map.

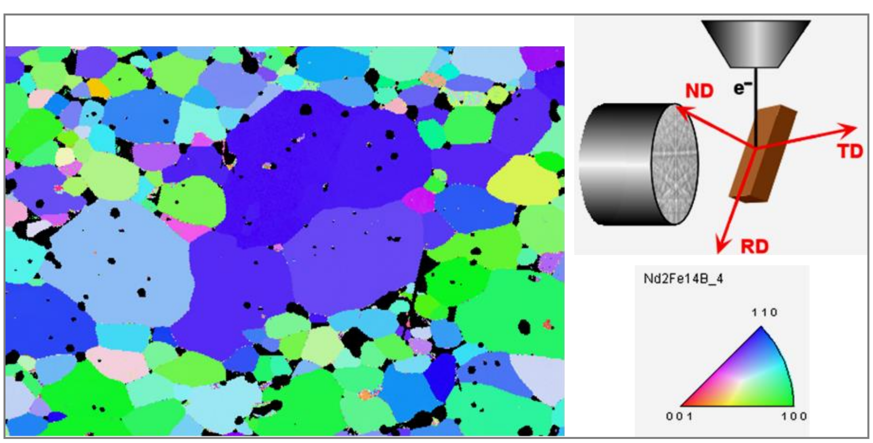

Figure 3. EBSD map (IPF) of Nd sintered magnet, collected with EDAX TSL system.

Another feature of JSM-7900F is the ability to perform EBSD analysis using an LDF mode (long depth of field). This mode allows collection of EBSD maps of a large specimen area in unattended fashion. An example of such analysis is shown in Fig. 4 – a large area of a solar cell device (polycrystalline silicon) was analyzed in 15 min (100 microns step, 75 points/sec) by acquiring maps from 3 adjacent analysis areas and stitching them together. If the stage movement was employed in this case to cover a wide specimen area, the same analysis would take over 10 hrs.

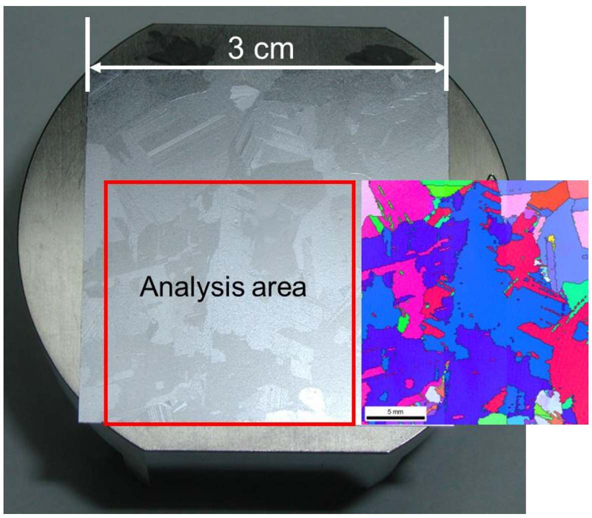

Figure 4. Wide area EBSD – montage of 3 adjacent areas stitched together. Sample – solar device (poly-Si).