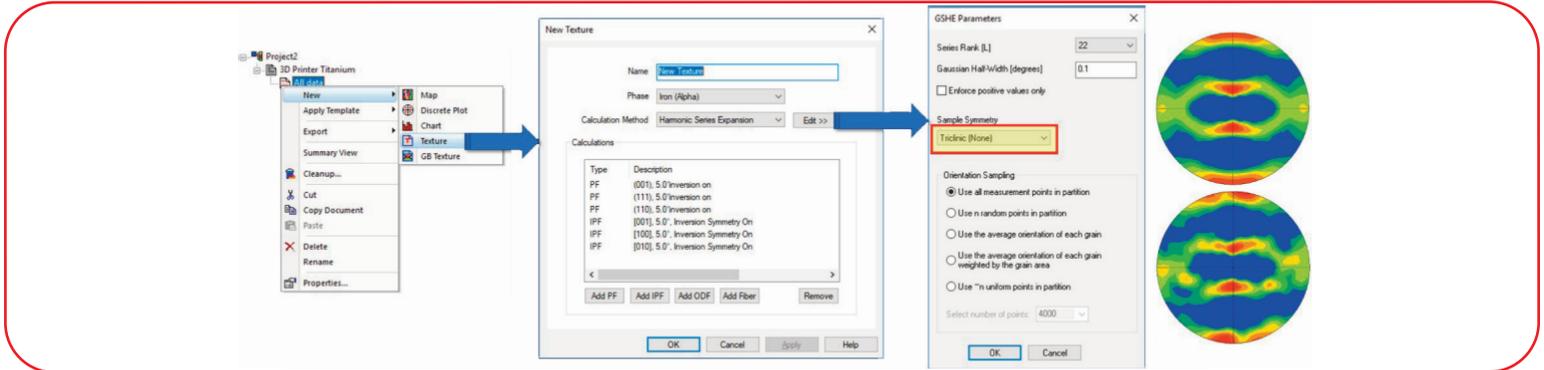# Sample Symmetry in Texture Calculations

Figure 2. Screen shots from OIM Analysis™ demonstrating how to calculate a texture with Triclinic (None) or orthotropic symmetry with accompanying (111) pole figures for rolled copper.

For those who attended Dr. Stuart Wright's recent webinar 'Texture Analysis via EBSD', he emphasized the need for sampling enough orientations for statistical reliability in characterizing a texture. Many forming processes are symmetric in nature and produce a texture that shows symmetry beyond crystallographic symmetry. In crystallographic symmetry, after a symmetry operation is applied, the crystal is left in an orientation indistinguishable from the original. For example, consider a crystal with cubic symmetry. A 90°, 180° or 270°
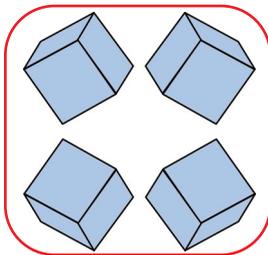

Figure 1. Four orientations of a cube related through vertical and horizontal mirror planes.

rotation about any of the face normals of a cube would leave the cube in an orientation that is indistinguishable from the original. However, sample symmetry is different. The classic example is rolled sheet, where there are mirror planes in the vertical and horizontal directions. In the bulk of the material (where surface effects due to friction between the material and the rolls are negligible) we expect the set of lattice orientations shown in Figure 1 to be present in the material with the same frequency. This sample (or statistical) symmetry thus differs from crystal symmetry as the orientations are distinguishable from each other. To reach "statistical"

symmetry in EBSD measurements, many grain orientations must be sampled.

There are several tools in OIM Analysis™ to explore sample symmetry. Figure 2 shows the workflow for calculating a texture in the standard way with triclinic symmetry. The same steps should be repeated to calculate a texture with sample symmetry with the exception of changing the sample symmetry to orthotropic where highlighted. An example (111) pole figure for rolled copper shows the effect of applying orthotropic symmetry (top) compared to a pole figure calculated without enforcing sample symmetry (below).

There is a way in OIM Analysis™ to quantitatively compare how similar these two textures are. This is done using a Texture Difference Index (TDI) Chart as shown in the following sequence (Figure 3). Pressing the "Edit >>" button allows you to choose the two textures you want to compare. The resulting plot shows the TDI as a function of the rank of the series expansion used to calculate the textures. As the rank increases the resulting texture captures finer details and increases the TDI. For more details on the TDI, read Dr. Wright's EDAX Blog post 'Old Eyes?'.
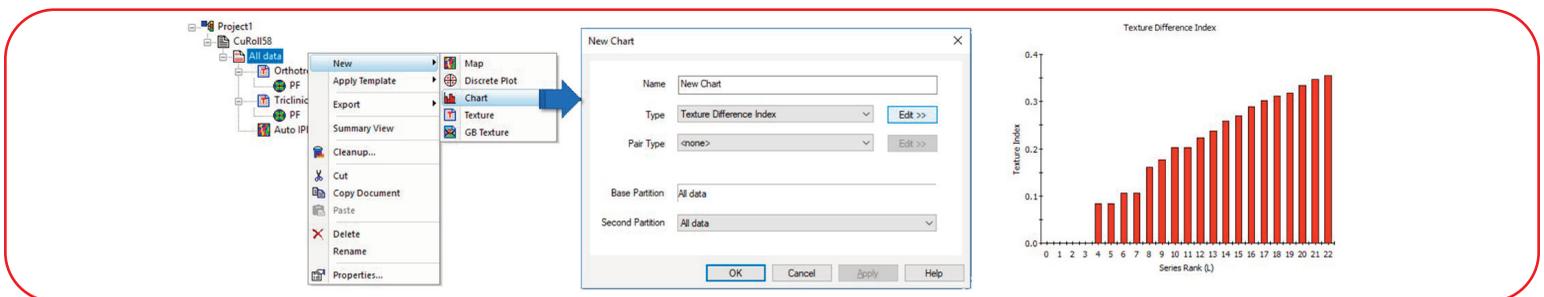

Figure 3. Screen shots from OIM Analysis™ demonstrating how to generate a texture difference index plot to compare two different textures.

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