Texture and Anisotroy

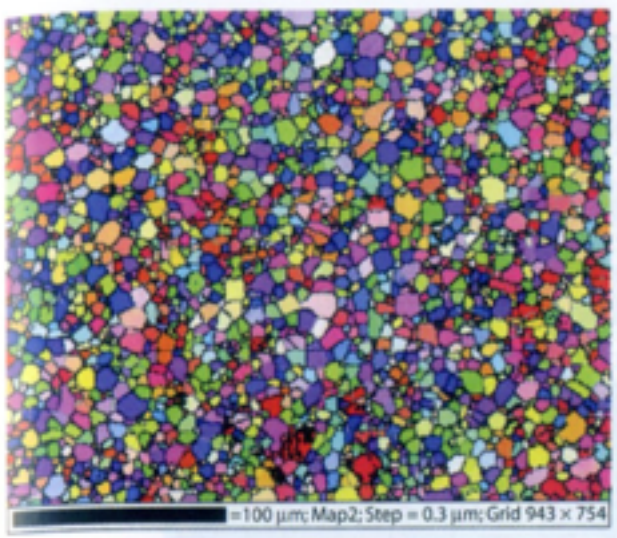
Part III:

Chapter 10. Orientation microscopy and orientation mapping

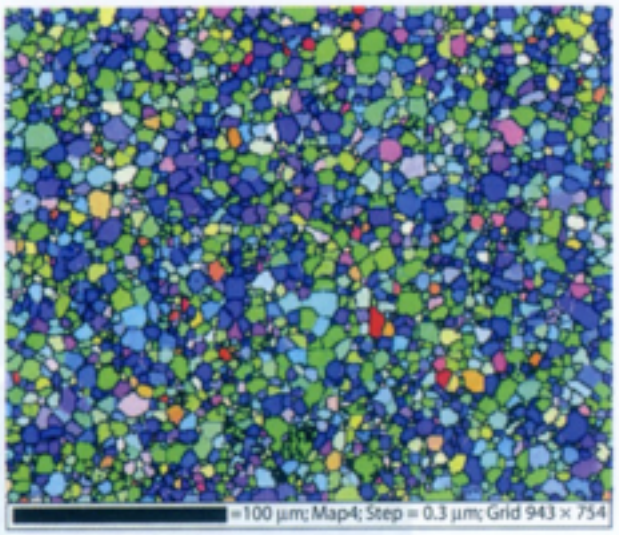
Applications of orientation mapping

1. Spatial distribution of microtexture components
2. Misoreintations and interfaces
3. True grain size/shape distributions
4. Pattern quality maps
5. Phase maps

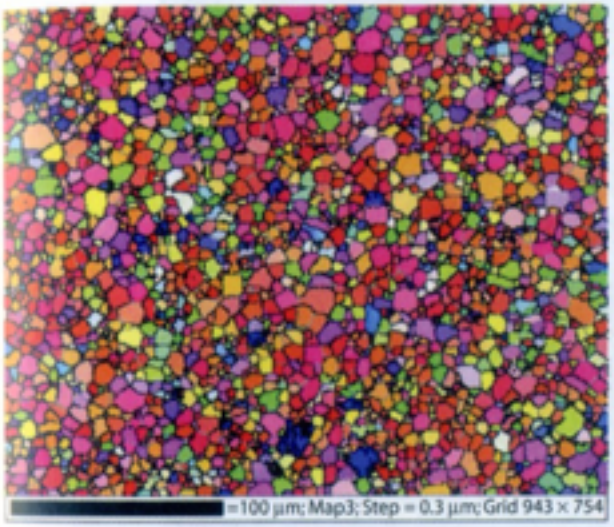
Spatial distribution of microtexture: Ti



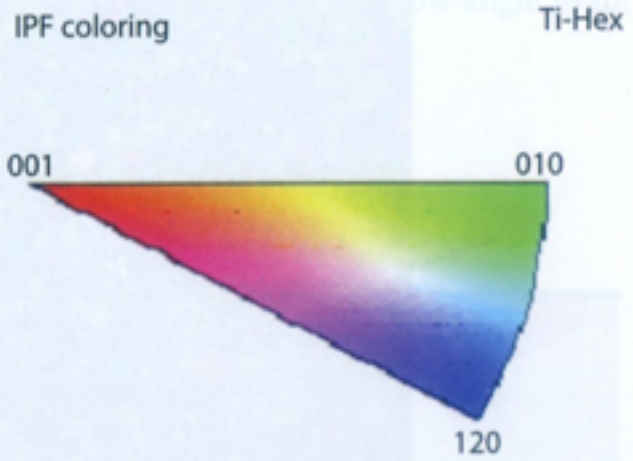
(a)



(b)

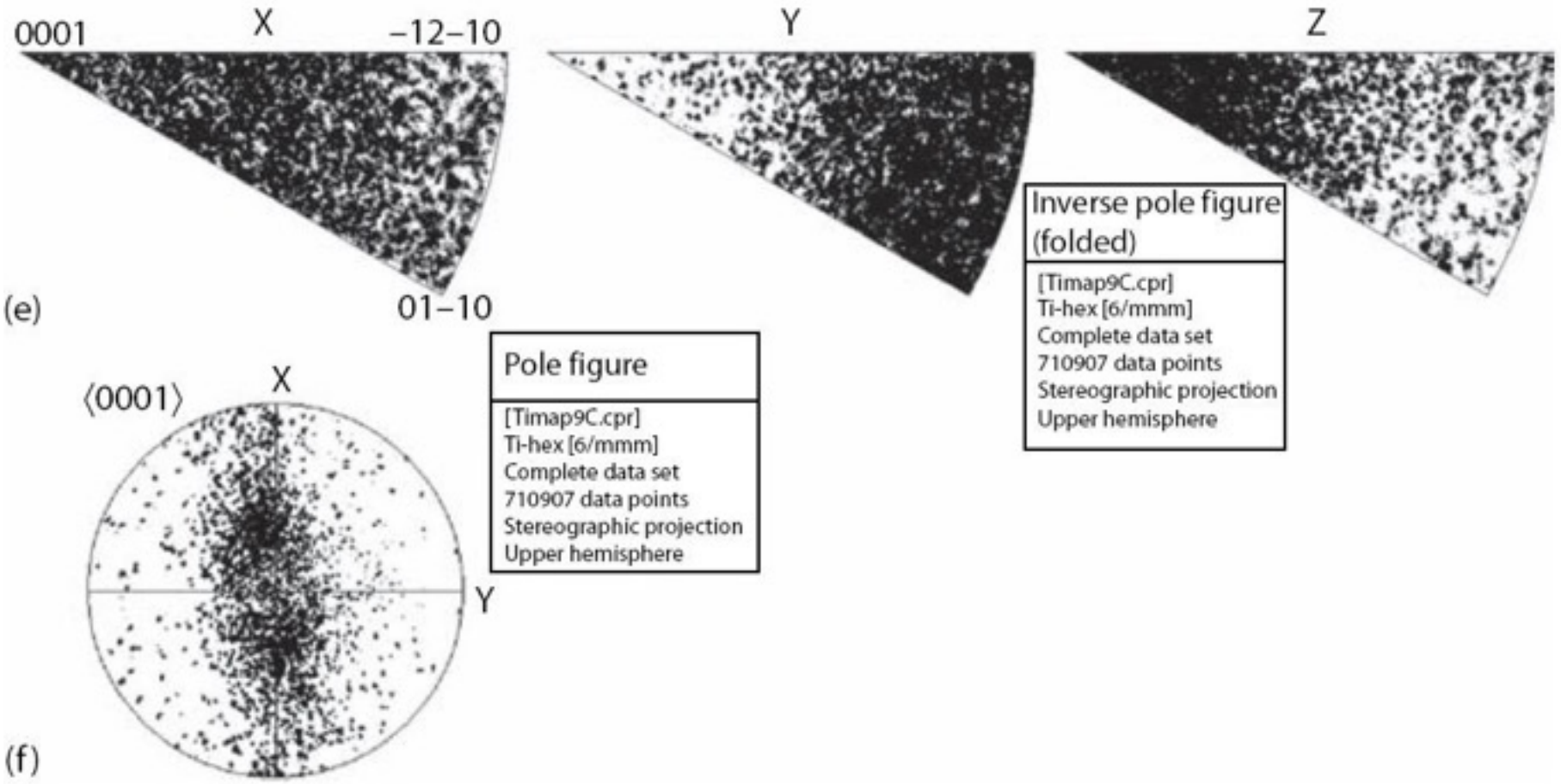


(c)

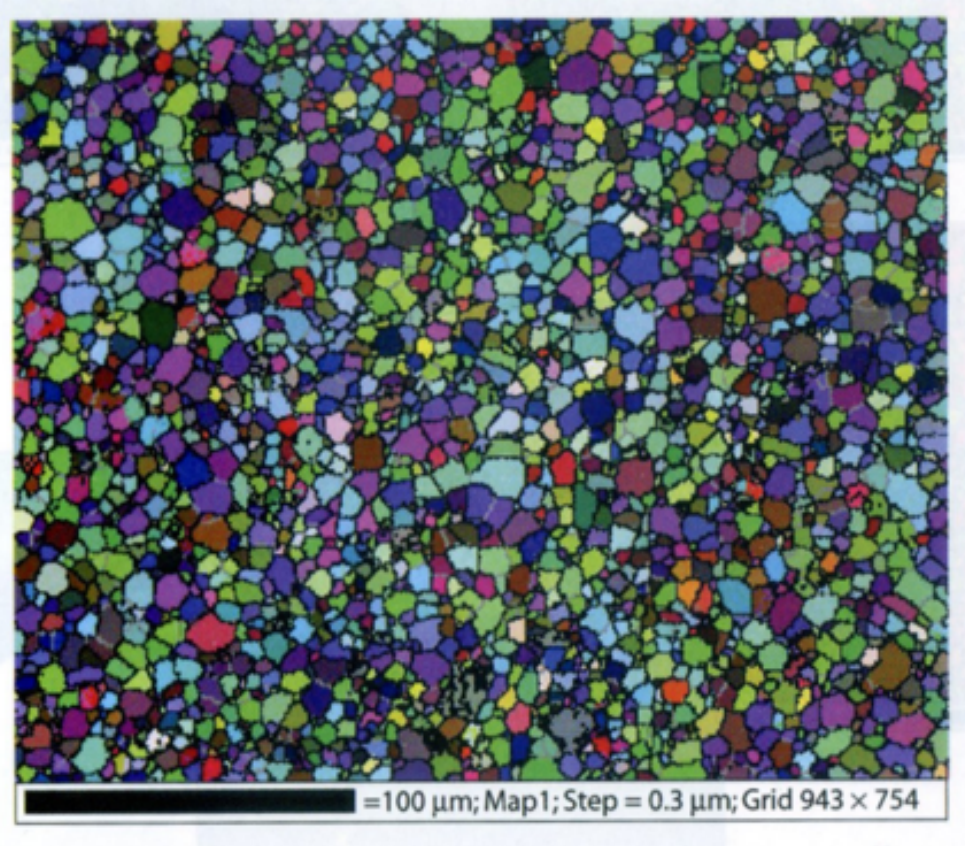


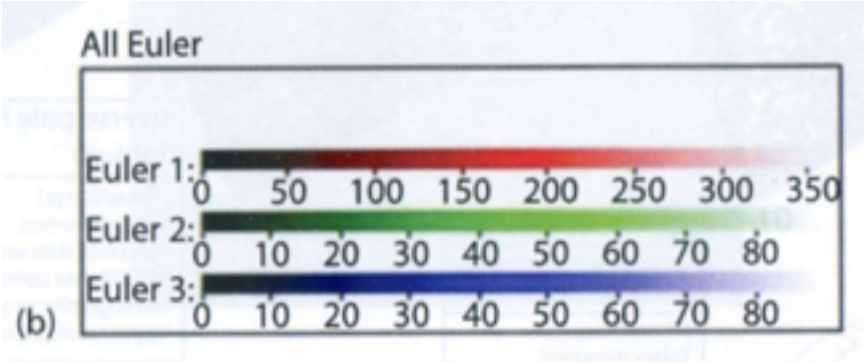
(d)

Spatial distribution of microtexture: Ti

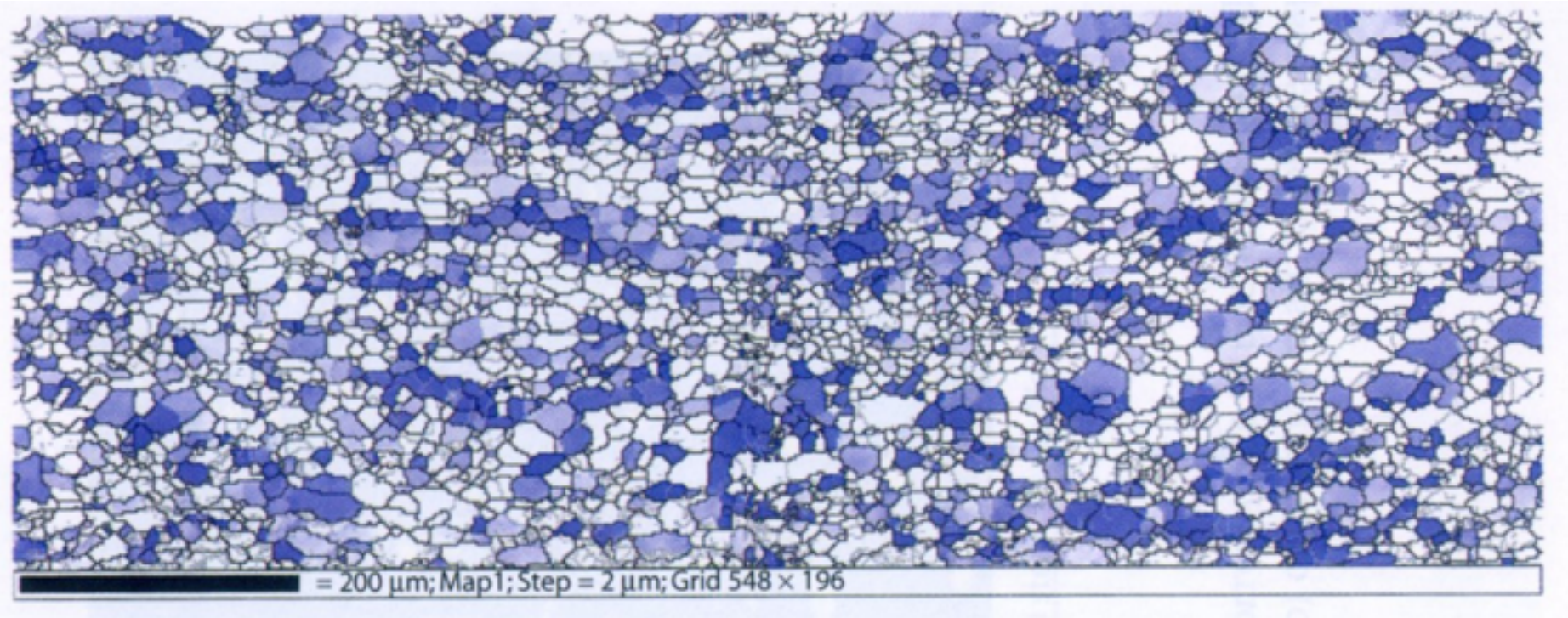


Euler angle orientation map: Ti



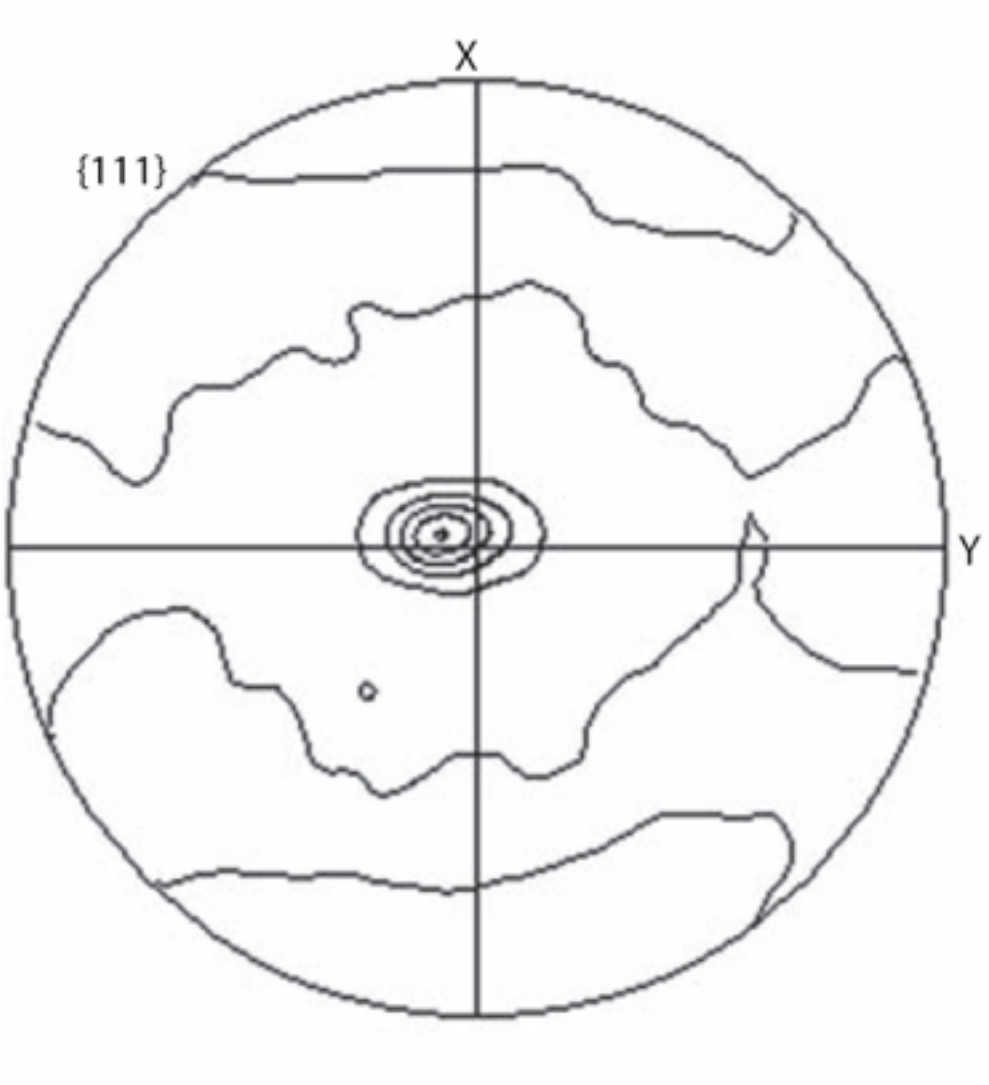


Orientation direction map of FeSi



(a) Orientation map from silicon iron showing grains colored in blue if the specimen Z (normal) direction is <20° from ⟨111⟩. The depth of color diminishes with increasing deviation from exact ⟨111⟩. High-angle grain boundaries are depicted by black lines and low-angle grain boundaries by gray lines.

{111} pole figure



Pole figure

[H75.cpr]
Iron bcc (old) [m3m]
Complete data set
107408 data points
Stereographic projection
Upper hemisphere

Half width: 10°
Cluster size: 3°

Exp. densities (mud):
Min = 0.10, Max = 5.06

1
2
3
4
5

(b)

Orientation map of FeSi

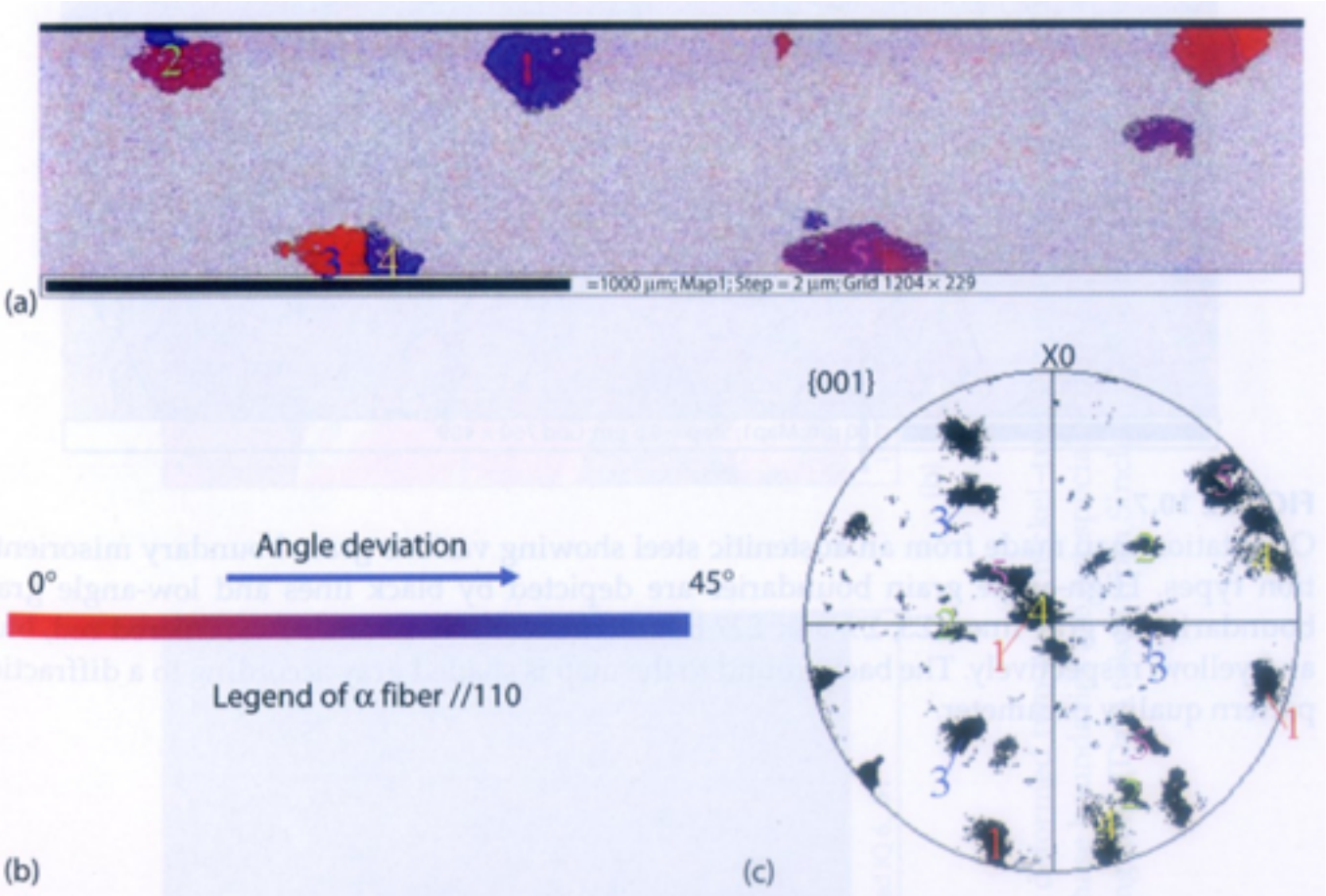


FIGURE 10.6
(a) Orientation map from silicon iron showing large grains (numbered) arising from abnormal grain growth. (b) User-defined color key for the map in (a); grains are colored according to proximity to the "α fiber," that is, ⟨110⟩ parallel to the rolling direction. Red depicts the exact α fiber, changing to blue for orientations having the maximum deviation from the α fiber (45°). (c) {001} Pole figure showing the orientations of the large grains, numbered accordingly, in (a). The rolling direction is horizontal (parallel to the specimen X direction).

Grain boundary map of austenitic steel

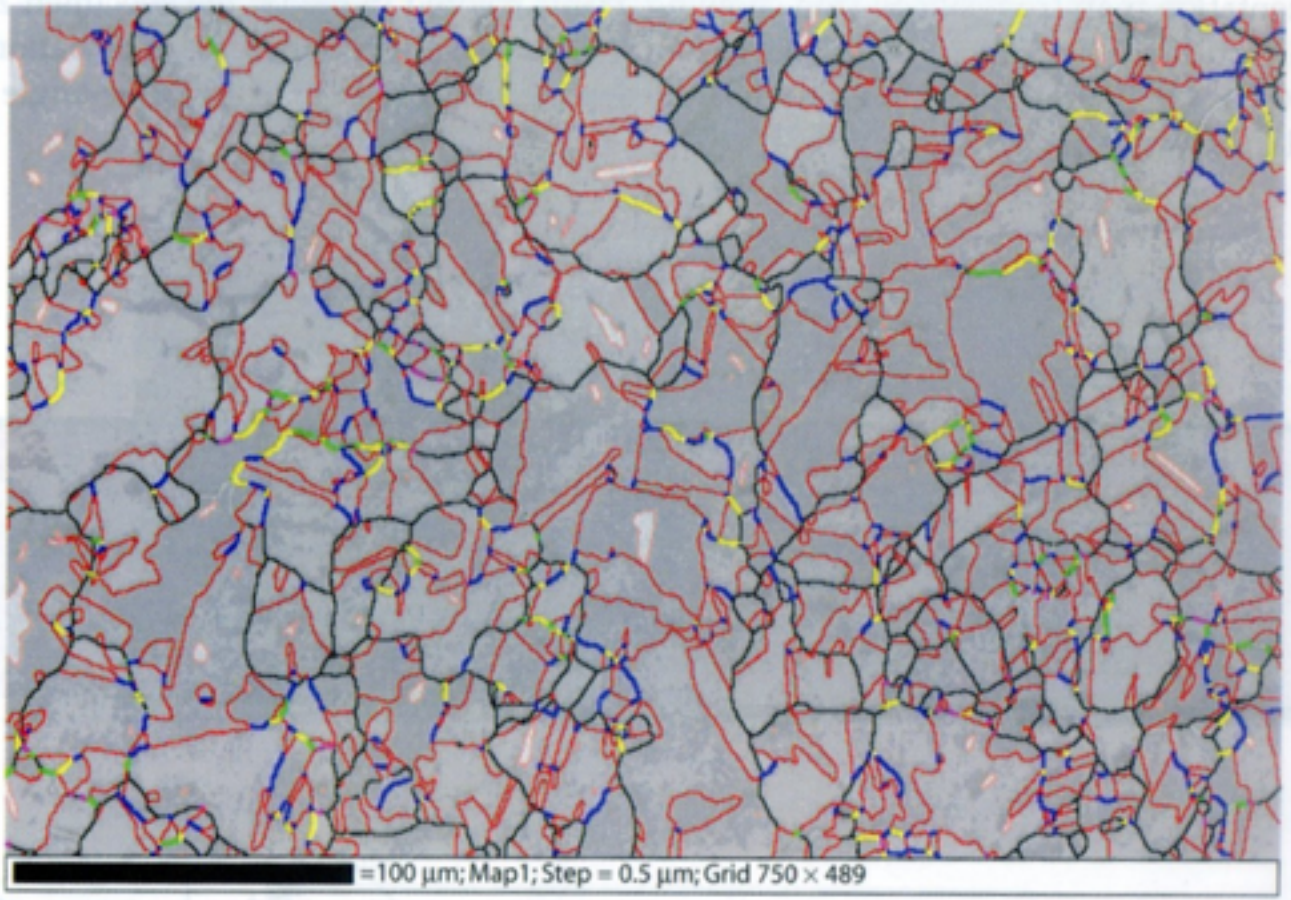


FIGURE 10.7
Orientation map made from an austenitic steel showing various grain boundary misorientation types. High-angle grain boundaries are depicted by black lines and low-angle grain boundaries by gray lines. Σ3, Σ9, and Σ27 boundaries (in CSL notation) are colored red, blue, and yellow, respectively. The background to the map is shaded gray according to a diffraction pattern quality parameter.

Orientation map

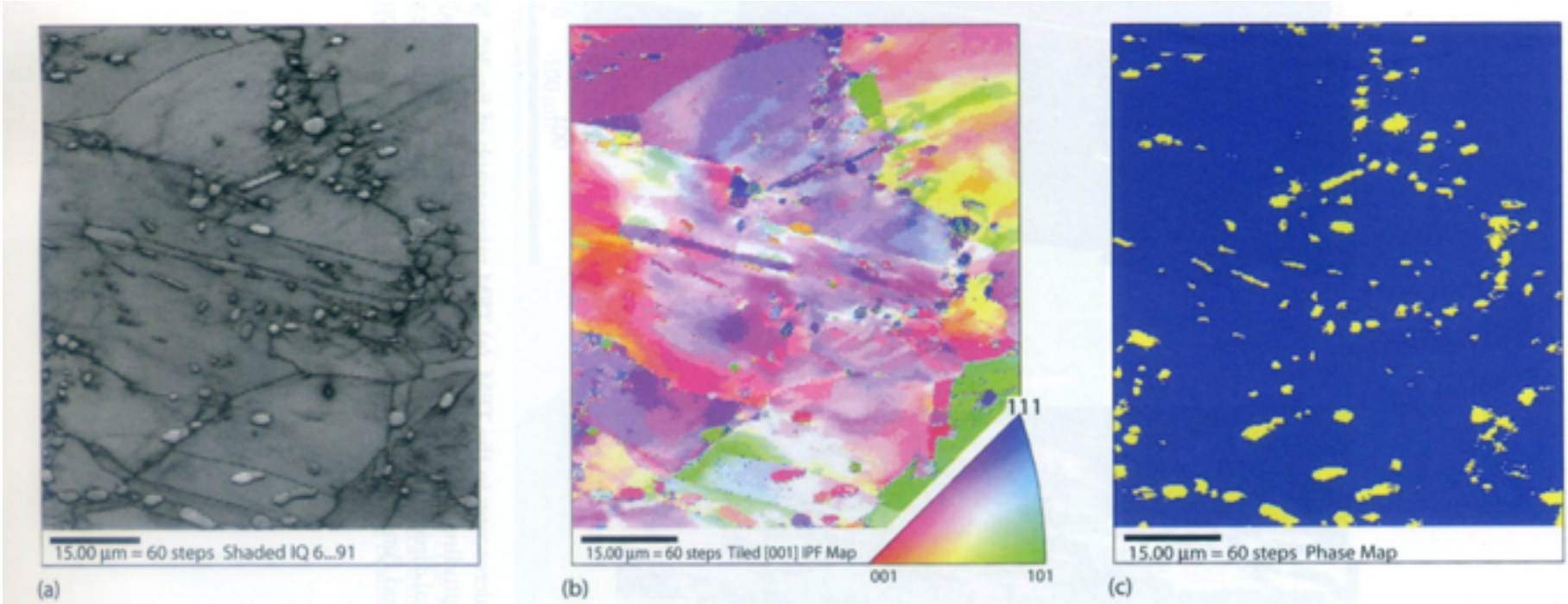


FIGURE 10.8
EBSD analysis of a mildly deformed two-phase nickel–tungsten specimen. (a) Image quality map (darker shading corresponds to poorer image quality. Note that grain and phase boundaries are not specially marked, but show up due to their low image quality.); (b) orientation map; (c) phase map (blue—nickel; yellow—tungsten). (Data taken from Sinclair, C.W. et al., *Mater. Sci. Technol.*, 19, 1321, 2003.)

Orientation map in TEM

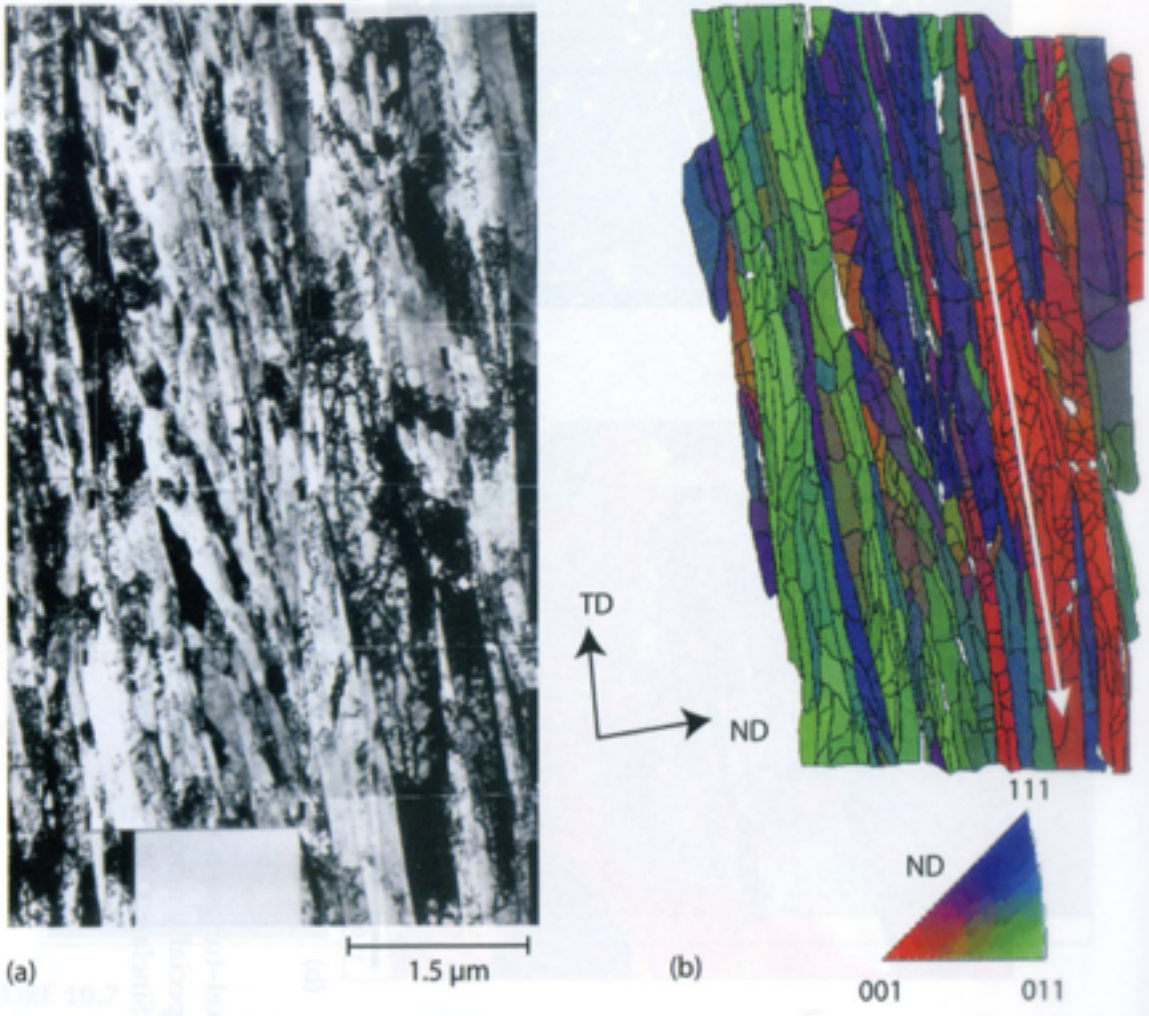


FIGURE 10.9
Example of orientation microscopy in the TEM. (a) TEM micrograph of Fe–36% Ni deformed 94% by cold rolling (longitudinal section, i.e., ND–TD plane); (b) orientation map of (a). The colors correspond to crystal directions parallel to the normal direction (ND) of the sheet. (From Zaefferer, S., Baudin, T., and Penelle, R., *Acta Mater.*, 49, 1105, 2001. With permission.)