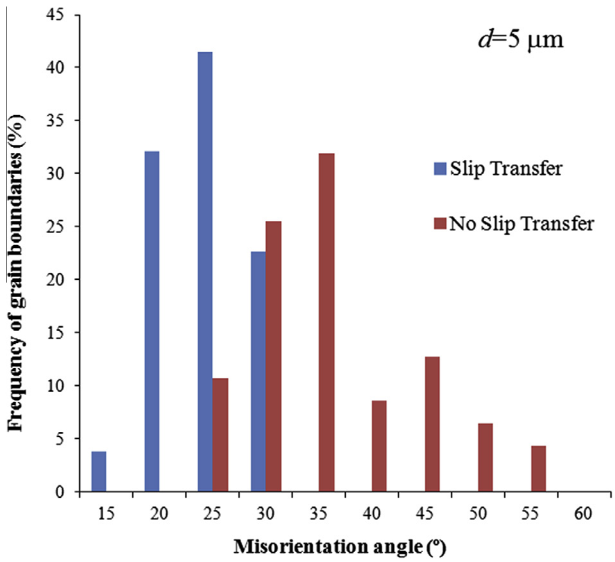

Fig. 4. Polycrystal with $d = 5\,\mu m$ tested at 50 °C and $10^{-3}\,s^{-1}$. Misorientation distribution histogram of GBs inside the deformation bands across which basal slip transfer could take place (blue bars) and of those at which slip traces were arrested (red bars). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

favorably oriented for basal slip was performed in the two polycrystals investigated. The following assumptions have been made in order to carry out this analysis. Taking into account that the initial CRSS for twinning is approximately twice that of basal slip [3] and since the average SF for twinning ($SF_{twinning}$) in the two investigated polycrystals is ~0.4, a "grain well oriented for basal slip" has been defined as that in which $SF_{basal} > 0.2$. This seems a reasonable assumption since, as can be seen in Fig. 3i, the SF_{basal} of most grains within the deformation bands is larger than 0.2. Fig. 5 illustrates two large EBSD IPF maps in which grains with $SF_{basal} > 0.2$ are highlighted in the pure Mg polycrystals with $d = 19\,\mu m$ (Fig. 5a) and $d = 5\,\mu m$ (Fig. 5b). The corresponding misorientation distribution histograms are depicted next to the EBSD maps. The basic state variable used in GB percolation problems is the fraction of special boundaries in the network [49]. Here, GBs with $\theta < 30°$ will be defined as "special" as they allow basal slip transfer. Thus, the degree of connectivity between the grains highlighted in Fig. 5 may be estimated, as a first approximation, by calculating the fraction of boundaries with $\theta < 30°$ ($f_{\theta<30°}$) from the corresponding misorientation distribution histograms. The $f_{\theta<30°}$ values for the two polycrystals with $d = 19\,\mu m$ and $d = 5\,\mu m$ are 63% and 73%, respectively. Although these data suggest that, indeed, the grains that are favorably oriented for basal slip are better connected in the finest polycrystal, the difference between both $f_{\theta<30°}$ values is small. An additional measure of network connectivity, which takes into account that GBs of different types are not randomly distributed in the network, is the triple junction distribution, which gives information on the coordination of special GBs at triple junctions [49,50]. Fig. 6 shows GB misorientations maps corresponding to grains

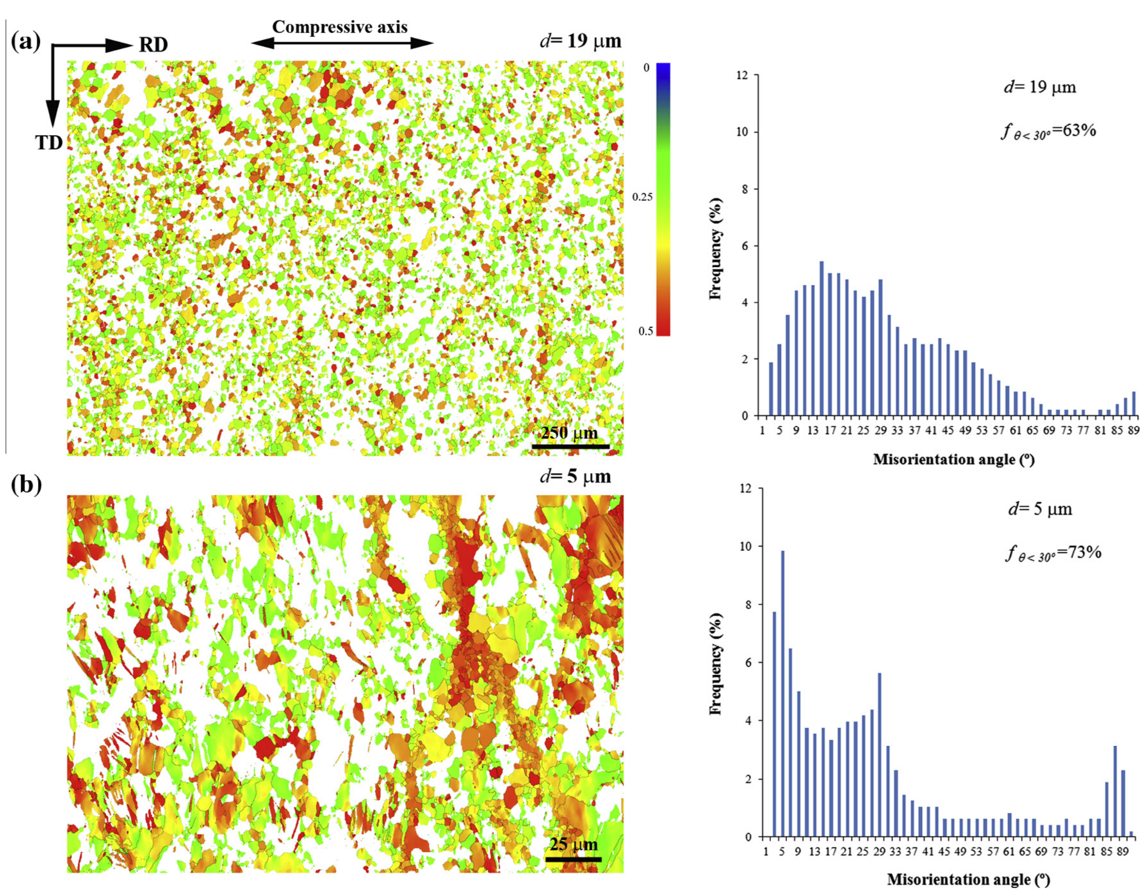

Fig. 5. EBSD maps showing the grains with $SF_{basal} > 0.2$ in the polycrystals with (a) $d = 19\,\mu m$ and (b) $d = 5\,\mu m$ and, next to them, the corresponding misorientation distribution histograms.