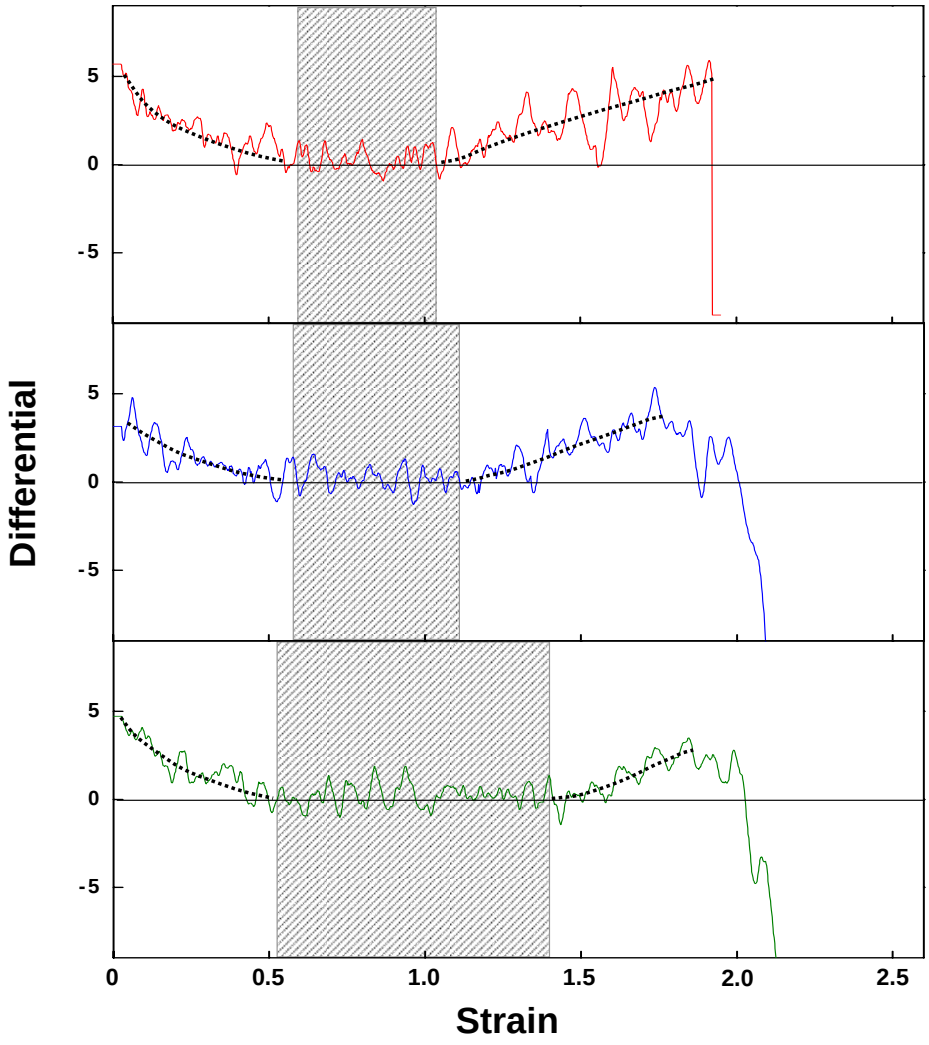
Supporting Information.

Determination of critical strain

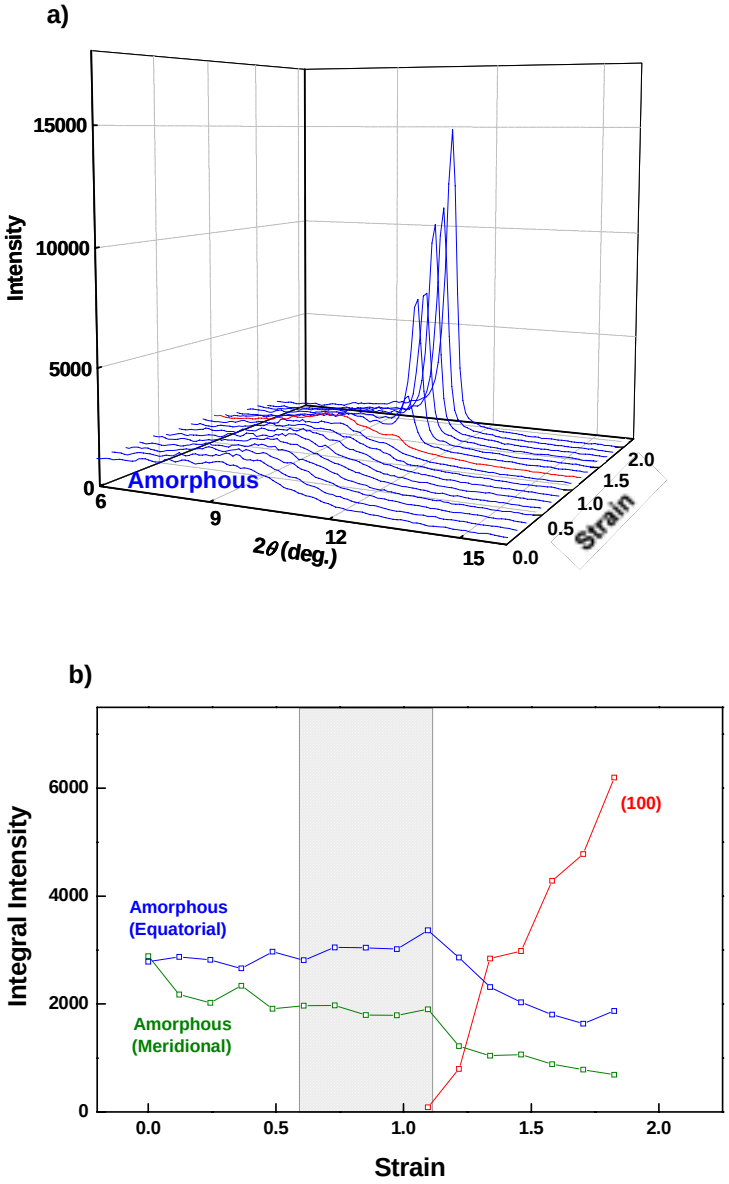
In order to resolve the boundary between the plateau stress region and strain-hardening region, the deviations were calculated for the stress-strain curves recorded at 370°C for three MW films. The zero-deviation region, indicated by shaded area, corresponds to the plateau stress region in the original stress-strain curve. The end of this region for each MW film was plotted in Figure 9.



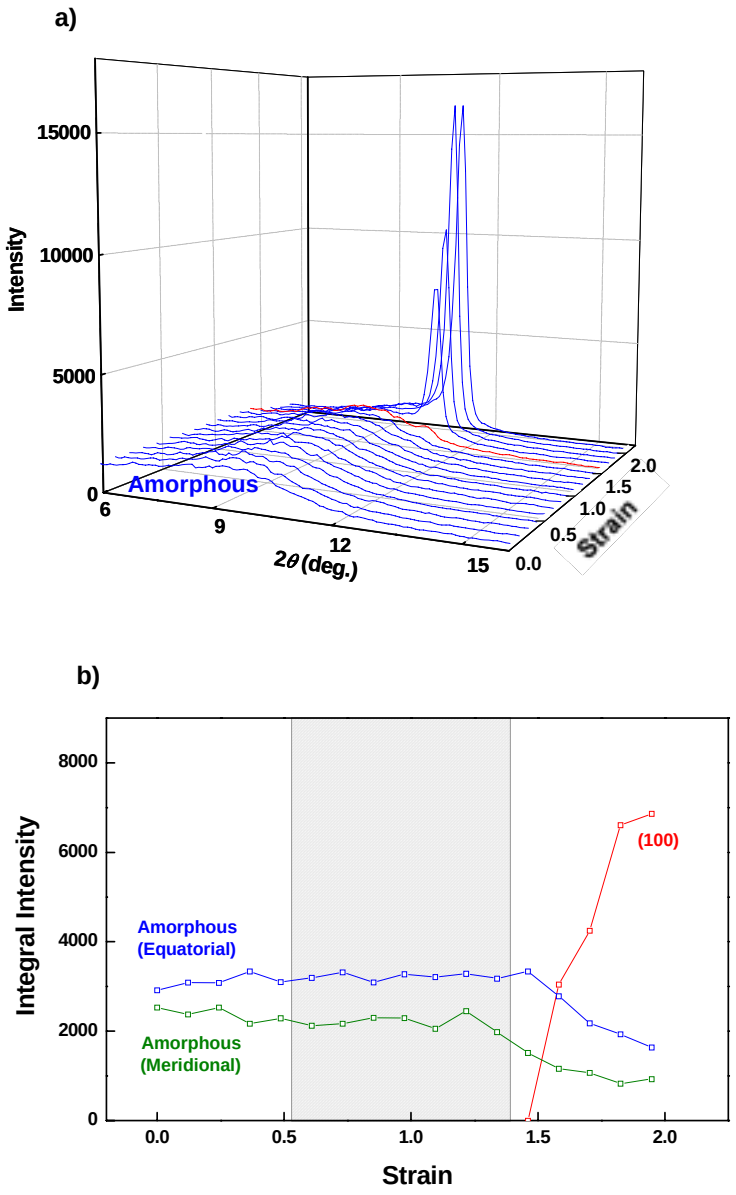
Supplemental figure 1. Differential plots estimated from the stress-strain curves recorded at 370°C for three MWs films. Top, M_n = 1.0 x 10^7 film; middle, M_n = 4.0 x 10^6 film; bottom, M_n = 2.0 x 10^6 film. The gray shaded area indicates the estimated zero-differential region. The dotted lines are the smoothed slopes before and after the zero-differential region.

Detailed WAXD data analyses for the lower MW films.

The equatorial line profiles were extracted from the series *in-situ* WAXD patterns obtained for the melt-drawing of lower MW films. The component changes of amorphous and crystalline phases were also estimated through a peak-resolution analysis of the series of these equatorial profiles.



Supplemental figure 2. (a) 3-D plot of WAXD line profiles extracted along the equators of the series of *in-situ* WAXD patterns recorded during melt-drawing for M_n = 4.0 x 10^6 film in Figure 7. The red profile was obtained at a critical strain of 1.1. (b) Comparison of changes in integral intensities estimated from peak resolutions of the equatorial line profiles in (a). The plot colors and shade mean the same as in Figures 4 and 5.



Supplemental figure 3. (a) 3-D plot of WAXD line profiles extracted along the equators of the series of *in-situ* WAXD patterns recorded during melt-drawing for M_n = 2.0 x 10^6 film in Figure 8. The red profile was obtained at the critical strain of 1.5. (b) Comparison of changes in integral intensities estimated from peak resolutions of the equatorial line profiles in (a). The plot colors and shade mean the same as in Figures 4 and 5.