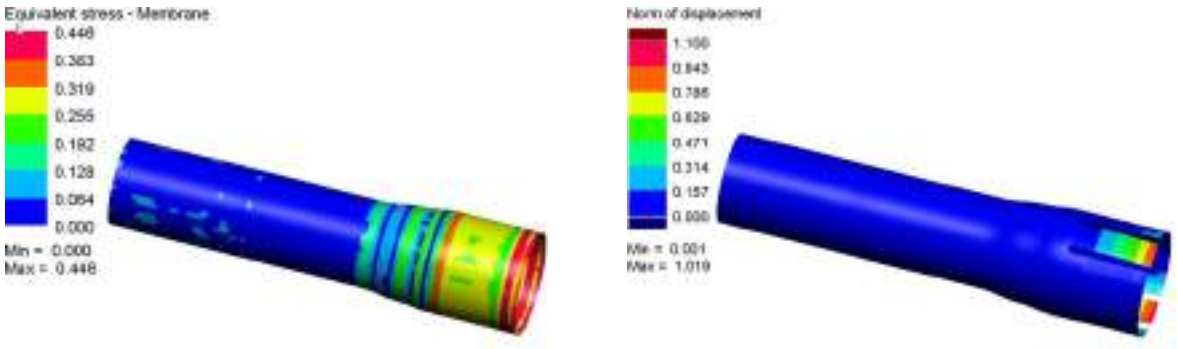
Investigation of Shape Deviations of Expanded and Slitted Tube Ends

Kay Lorenz Langhammer[1, a)] and Bernd Engel[1, b)]

[1]Institute of Forming Technology
University of Siegen, Breite Straße 11, D-57076 Siegen, Germany

[a)] Corresponding author: Kay.Langhammer@Uni-Siegen.de
[b)] Bernd.Engel@Uni-Siegen.de

Abstract. The expansion of tube ends is often realized by axial forming with a mandrel. Usually, the purpose of this forming is to allow the expanded tube end to be fitted onto another tube end. In order to ensure the tightness of this connection, the expanded tube end is slit so that it can be clamped. Residual stresses are released from the expansion process, among other things, resulting in shape deviations in the form of out-of-roundness. In this case, reworking must be carried out in order to enable joining. The required tightness must be maintained by all means if the tubes are used to conduct fluids. The aim of the research is therefore to minimize the residual stresses caused by expansion. For the suitability of the component, however, it is not the residual stress distribution itself that is important, but the resulting shape after trimming. For this reason, a FE simulation model was created which was used to compare the calculated residual stress distributions, as illustrated in Fig. 1 (a), and the resulting shape deviations after cutting, as illustrated in Fig. 1 (b). The influences of qualitative and quantitative process parameters were analyzed, in particular those of the mandrel geometry. Among other things, a mandrel geometry is examined and optimized which effects a two-stage forming in one stroke. The simulation results are validated with a series of experiments.



(a) (b)

FIGURE 1. (a) Visualization of the equivalent stresses resulting from the expansion of the tube end. (b) Visualization of the displacement of the elements after slitting.