Effect of the unbending process on mechanical properties before and after flattening of extruded open tubes of magnesium alloy ME20

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Abstract. Magnesium alloys are promising candidates for the replacement of steel and aluminum in the transportation industry. Extrusion of open tube profiles and flattening the tubes afterward is one possible method for manufacturing wider magnesium alloy sheets. In this paper, warm-extruded magnesium alloy ME20 sheets are analyzed experimentally. In this context, extruded profiles are expanded and finally flattened in a press machine. In order to investigate the influence of the unbending and flattening on the properties of the magnesium sheets, tensile tests at room temperature as well as at elevated temperatures are performed for both the open tube profile and flattened sheet. The microstructure of both states is also investigated. According to the results of the tensile tests, yield stress and ultimate strength are higher in the flattened sheet. The strain-rate sensitivity study for both states shows that the tubes indicate a higher strain-rate sensitivity with rising temperature. The fracture elongation increases differently for both states with increasing temperature. The intersection point of the hardening rate and true stress-strain curve, which hints the necking point, indicates that the sheet shows a higher formability before flattening. The microstructure investigation shows that the flattening process reduces the grain size heterogeneously. In case of the sheet, a higher strain hardening rate dominates the grain size refinement effect on formability, while the reduced grain size leads to higher work hardening.