Extrusion of magnesium alloy hollow profiles with axial variable wall thickness

Maik Negendank[1, a)] Vidal Sanabria,[2, b)], Sören Müller[1, c)], W. Reimers[3, d)]

[1]Extrusion Research and Development Center of TU Berlin, Gustav-Meyer-Allee 25, 13355 Berlin, Sekr. TIB 4/1-2
[2]INGWERK GmbH, Gustav-Meyer-Allee 25, 13355 Berlin
[3]TU Berlin, Chair Metallic Materials, Ernst-Reuter-Platz 1, 10587 Berlin, Sekr. BH18

[a)] Corresponding author: negendank@tu-berlin.de
[b)] vidal.sanabria@ingwerk.com
[c)] soeren.mueller@tu-berlin.de
[d)] walter.reimers@physik.tu-berlin.de

Abstract. For conventional extrusion processes rigid dies are applied. Thus, the cross section of the manufactured profile remains constant along its length. The cross section of a profile or the wall thickness of hollow profiles is designed according to the expected maximal load. But this load often is not applied homogenously along the length of a component. Hence, if it would be possible to extrude profiles with cross sections that can be locally adapted to the acting forces or stresses this would mean significant potential for weight and material savings. In this study the extrusion of magnesium hollow profiles with axial variable wall thickness was investigated. Therefore, a newly developed porthole die [NEG18] was applied and extrusion trials conducted in order to show the feasibility of producing load adapted magnesium hollow profiles with axially variable wall thickness. Billets of magnesium alloy AZ31 were extruded and the parameters of overall extrusion force, die force, friction force and profile temperature were measured during the experiments. After the extrusion tryouts the manufactured hollow profile sections were measured with respect to the development of wall thickness, inner and outer diameter in thin-walled, thick-walled and wall thickness transition areas. For the first variation the maximal moving distance of the die segments was limited and a maximal wall thickness variation of Δt=1.0mm was achieved. For a second tryout the limitation was removed and the wall thickness was reduced from 4.5mm to 0mm. Unfortunately, the moving segments thereby were ripped out off their bearings.

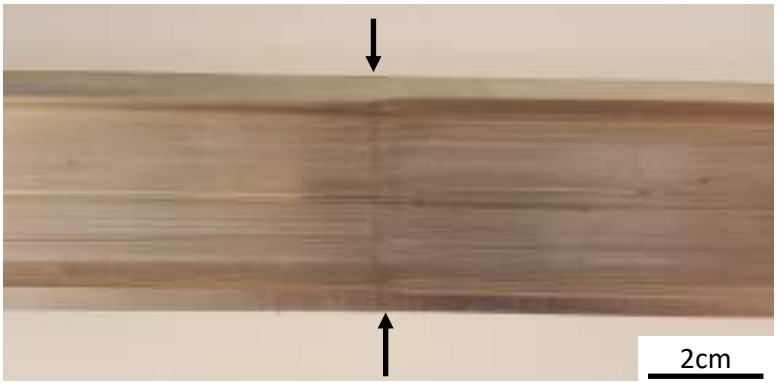

FIGURE 1. Longitudinal cut through a wall thickness transition area of an AZ31 hollow profile with local wall thickness reduction from t=4.5mm to t=3.5mm (Δt=1.0mm), arrows indicate start of wall thickness variation, extrusion direction ←