

## **Microstructure aspects of deformation of hot extruded and pilger rolled Mg-based alloy pipe**

### **ABSTRACT**

Contemporary trends in vehicle and airplane designing place great emphasis on the reduction of the weight. This contributes to energy saving and to reduction of their negative environmental impact. One of the methods of weight reduction is use of magnesium alloys. Magnesium is the lightest element with desirable mechanical properties and relatively low reactivity. Moreover, it is abundant in the Earth's crust and its use is environment-friendly.

However, due to the low plasticity of magnesium in room temperature, metalworking of commercial magnesium alloys is difficult and is limited by the risk of accumulation of large residual stresses, which significantly influence the material behavior in exploitation conditions. Configuration and the magnitude of residual stresses may exert both beneficial and detrimental effects on structural element. The stress field may build up as a consequence of cyclic loads, leading to decrease of fatigue resistance of the material.

The reported experiments were performed on a Mg-based alloy (AZ31) pipe fabricated by hot extrusion technology and then cold rolled with pilger method. Pilger rolling with mandrel caused 50% reduction of the wall thickness. X-ray diffraction technique was used to determine the level of residual stresses in the initial and deformed state. The stresses and texture measurements were taken on a lateral surface of the pipe.

Due to an essential preferred orientation of the examined material, the stress analysis requires a modification of widely applied  $\sin^2\psi$  method. The modification consists in taking into account the orientation distribution function (ODF) in calculation procedure based on the Reuss model of the effective elastic constants. The suitable procedure was introduced. The obtained results and observed microstructure changes that accompanied the applied treatment (pilger rolling) are reported in the work.

**Keywords:** AZ31, pilger rolling, residual stresses