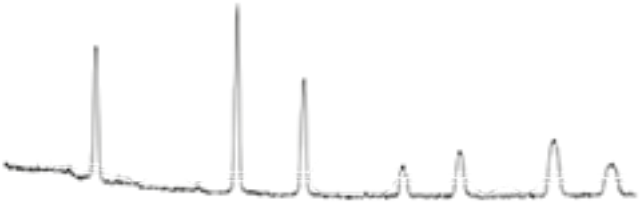

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# Influence of build direction on residual stresses and textures in lightweight alloys produced by additive manufacturing (AM)

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The freedom in complexity of AM metal parts allows very stiff and extreme light designs with real parts made of AlSi11Mg0.5 alloy entering serial production in automotive industry amongst others. Nevertheless, the production process of selective laser melting (SLM) is prone to the formation of residual stresses (RS), which can be large enough to destroy the part already during manufacturing. Furthermore, the parts may have distortions and must undergo a subsequent heat treatment to release RS, which is not always possible and cost as well as energy intensive. Therefore, a pro-found understanding of the formed RS is mandatory for structural integrity assessment and successful industrial manufacturing suitable for air, space and vehicle industry. The SLM production process is closely linked to texture formation in building direction of AM parts, which results in anisotropic mechanical properties.
In the current presentation, we investigate the evolution of residual strains and texture of an additively manufactured AlSi11Mg0.5 alloy component as function of building directions. High energy synchrotron X-rays are used to assess the strains of the different phases in this alloy and corresponding pole figures are derived to correlate the texture with the resulting stress profiles. In addition the influence of heat treatment on the strain level is studied as a function of spatial position within the AM parts. A brief outlook how this results can be used to qualify and mitigate stress induced failure mechanism in real parts will also be given.

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