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Strategy for solid-state recycling of metallic machining chips using FAST/SPS with focus on microstructure development

The efficient recovery of materials with high intrinsic economic value is gaining increasing importance. Driven by limited local resource availability and growing efforts toward strategic autonomy, processes enabling the direct and local reuse of materials, particularly critical raw materials, are attracting increasing interest. However, metallic scrap with a high surface-to-volume ratio, such as machining swarf and chips, is often unsuitable for remelting, as thermal processing efficiency is reduced by oxidation, gas uptake, phase transformations, and evaporation losses. Furthermore, alloy-specific segregation and phase dissolution may lead to the loss of tailored material properties.
Solid-state recycling routes overcome these limitations and are therefore gaining relevance, for example through hot extrusion or powder metallurgical approaches. FAST/SPS (Field Assisted Sintering Technique/Spark Plasma Sintering) is a fast and robust pressure-assisted sintering process that enables the production of dense semi-finished products from metallic chips. This contribution presents initial experimental results from a systematic, model-supported investigation of the sintering of aluminium-based chips, focusing on material yield, reuse potential, and the influence of chip morphology on the mechanical properties of secondary aluminium. In addition, novel modelling strategies for microstructural evolution during sintering are introduced to reduce experimental effort.

Professional Status of the Speaker

Doctoral or Master Student

Interest in submitting a paper in a special issue of

No interest

Invitation letter for visa

No

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