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Multi-alloy production via chips compaction and hot rolling

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Solid-state recycling techniques for metallic chips have been explored as a sustainable alternative to conventional remelting-based methods. The latest developments make these techniques promising in the production of bulk and dense materials, with the opportunity to obtain also multi-material components with this path. This study investigates the production of multi-alloy material through a combined process of chips compaction and hot rolling. AA6006 machined chips were used as metal matrix incorporating chips from different metal alloys dispersed within the matrix. The aim was to assess the feasibility of this approach in producing advanced multi-materials with gradient structures starting from waste materials as feedstock. The effect of key process parameters on the material's properties was evaluated including compaction pressure, rolling temperature, and rolling reduction ratio. Mechanical properties were assessed through tensile and hardness testing, while microstructural evolution was analyzed using optical microscopy (OM), scanning electron microscopy (SEM), and electron backscatter diffraction (EBSD). Correlations between microstructural features and mechanical behavior were identified. Preliminary results suggest that this method has potential for producing high-density multi-metal materials, opening for further exploration of this technique as a versatile manufacturing approach for advanced materials.

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