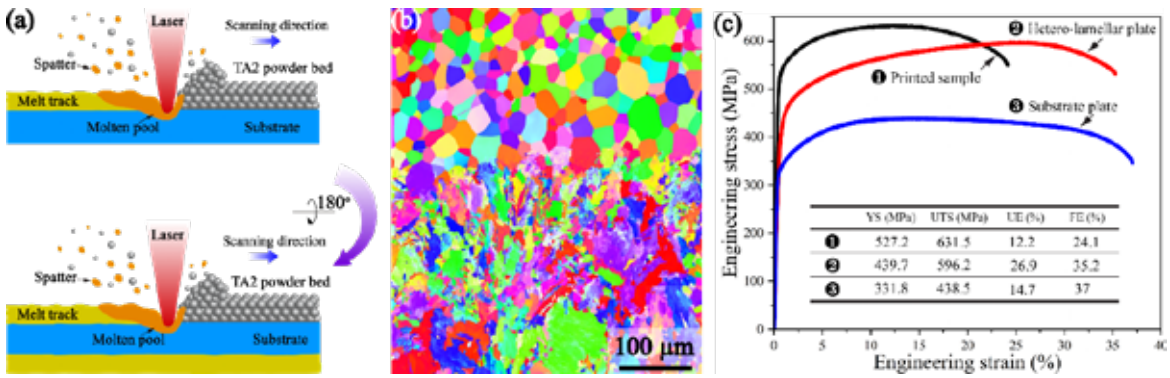
Highlight

Hybrid manufacturing of hetero-lamellar structured Ti for enhanced strength and ductility

Additive manufacturing of metallic components enables not only flexible design but also microstructural tailoring.

In this work, we present a methodology to fabricate a pure Ti plate featuring a sandwich-like hetero-lamellar structure and a uniform chemical composition by integrating additive manufacturing (laser powder bed fusion) and conventional manufacturing. The resulting layered structure, as well as the gradient microstructure within the printed layers, induces distinct deformation mechanisms across the plate thickness, thereby enhancing strain-hardening capacity compared with mono-structured Ti. The hetero-lamellar plate exhibits an outstanding combination of strength and ductility, achieving an exceptional uniform elongation of 27%.

This work offers a novel approach to producing hetero-lamellar structures with enhanced properties and paves the way for process optimization through hybrid manufacturing.



(a): Schematic diagram of the preparation strategy of the sandwich-like hetero-lamellar structured Ti plate. (b) Inverse pole figure coloring map showing the interface between the substrate plate of equiaxed grains and the printed layer of martensitic structure. (c) Room-temperature tensile properties of the hetero-lamellar Ti plate, the printed sample and the substrate plate.

For further reading, please see:

Shen J, Zhang C, Pan Z, Juul Jensen D & Yu T (2026), "Hetero-lamellar structure design for enhanced strength and ductility of Ti enabled via additive manufacturing", Materials Research Letters, 14, 29–37.