New "strain-transformable" beta titanium alloys for improved resistance/ductility/strain hardening compromise

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Owing to their high specific properties, titanium alloys have been, for a long time, highly competitive materials in fields such as aerospace industry. Among these alloys, research efforts were recently dedicated to design approaches for improved strength/ductility trade off. Guided by electronic parameters calculations, new "strain-transformable" Ti alloys have been developed and both single phase and dual phase materials have been optimized. Thanks to the synergy between stress induced martensitic transformation (TRIP effect), intense mechanical twinning (TWIP effect) and dislocations glide, these new materials display a combination of high fracture strength (up to 1400MPa), extra-large work-hardening and superior ductility (up to 45% at fracture).

In this talk, design strategy and microstructural optimization approaches of this new family of alloys will be discussed regarding the occurrence, chronology and synergy of the different deformation mechanisms. From this work, future directions towards both compositional and microstructural optimization pathways will be drawn and discussed.